DECEMBER, 1924

62

25 Cents $1 a Year

Contractors' and Engineers' Monthly

THE JOHN CRERAR
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Hot Concrete Can't Freeze

Aeroil

Concrete Heaters attached to Concrete Mixers produce hot concrete, which hardens rapidly and sets before it has a chance to freeze

Prevents Costly Delays and Shut Downs

Heats the aggregates while mixing in the drum to a temperature of from 70 degrees to 90 degrees F., even in zero weather.
Hot concrete remains warm from 48 to 56 hours after pouring.

Quick Relief from Snow and Ice with

Aeroil Kerosene Thawing Torches

For melting ice and snow out of forms, heating sand and gravel, thawing frozen ground, drying concrete for waterproofing, melting ice and snow on roofs, etc.
Will thaw out and unload frozen sand, gravel, coal, coke or stone cars in from 1 to 3 hours, and are equally effective for:
Melting ice and snow around structural work.
Taking frost out of ground for laying conduit.
Thawing out cellar foundations for laying concrete floors.
Thawing out ground preparatory to excavating, etc.

Write for Bulletin No. 42-E *Today*.

AEROIL BURNER COMPANY, Inc.

Hudson Ave. at Main St.

Union Hill **New Jersey**

Manufacturers of Portable Water Heaters, Smokeless Asphalt Kettles, Lead Melting Furnaces, Smokeless Paving Tool Heaters, Concrete Heaters and Thawing Outfits.

VOL. IX. No. 6 CONTRACTORS' & ENGINEERS' MONTHLY DECEMBER, 1924
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Where to Purchase

A comprehensive classification of the leading machinery and supply manufacturers arranged for the convenience of contractors, engineers and public officials who may wish to secure information about construction equipment.

The Index to Advertisers faces the inside back cover. When writing to advertisers please mention the CONTRACTORS' & ENGINEERS' MONTHLY. A star (*) before the manufacturer's name indicates that his advertisement appears in this issue.

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** Indicates that the manufacturer carries an advertisement. See index facing inside back cover.*

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KOEHRING K HEAVY DUTY

Crane Excavator

Easy Control Means Speedy Action! Capacity!

THE operator handles the Koehring Crane with his fingers—not with his weight! He can shift the levers with light pressure! Pedals are as easy! Double outside-band friction clutches make control easy. Operator maintains top capacity every minute of the day. Besides, easy control gives zip and speed to every function.

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Write for Crane Excavator Bulletin CE 6.

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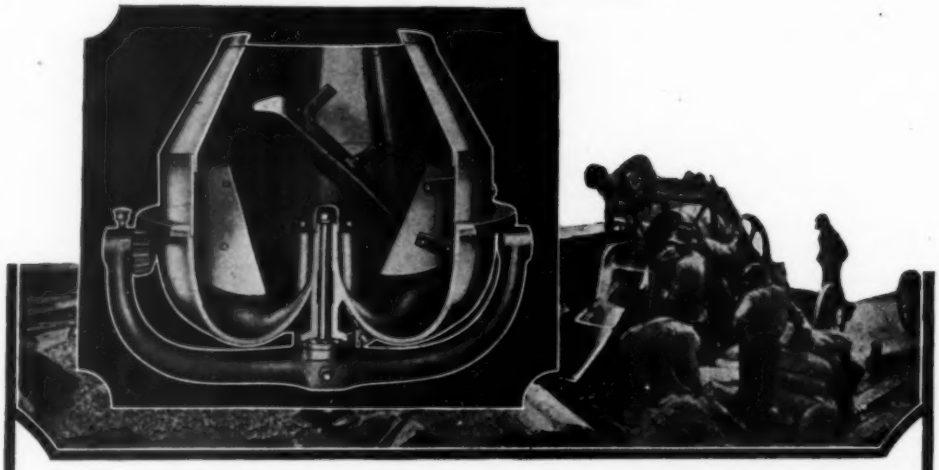

When In Doubt Buy a WONDER

TWELVE years ago the Construction Machinery Company originated the SINGLE-BEARING WONDER MIXERS. Unhampered by precedent or possibility of infringement, we adopted the design of Bearing pictured above—the stationary shaft support and the dust proof Ball Bearing Race to absorb the only wear there should be in a Mixer of this type.

Since then from time to time, other Manufacturers attracted by the popularity of the WONDER, have adopted the type but none have approached the perfection of the WONDER Bearing.

After twelve years of observation and knowledge gained from our thousands of users, it is now possible for the Construction Machinery Company to eliminate all confusion in the mind of the buyer concerning the correct design for the Bearing of a Single Opening Mixer. Without a change in its design during that period the WONDER Bowl Bearing now unqualifiedly carries the following guarantee to the purchaser:

GUARANTEE

We agree to furnish gratis any part of a WONDER MIXER drum bearing, if needed, during the life of a WONDER MIXER.

NOTICE

It is an infringement to make, use or sell a patented invention without authority under the patent. Our patents have been sustained by the United States Courts in six different instances. Purchasers of our Mixers are protected.

HERE IS LOW MIXER UP-KEEP GUARANTEED

CONSTRUCTION MACHINERY COMPANY

Formerly Waterloo Cement Machinery Corporation

447 Vinton Street **WATERLOO, IOWA**

Portable Machinery Co., Passaic, N. J.
Sessions Foundry Co., Bristol, Conn.
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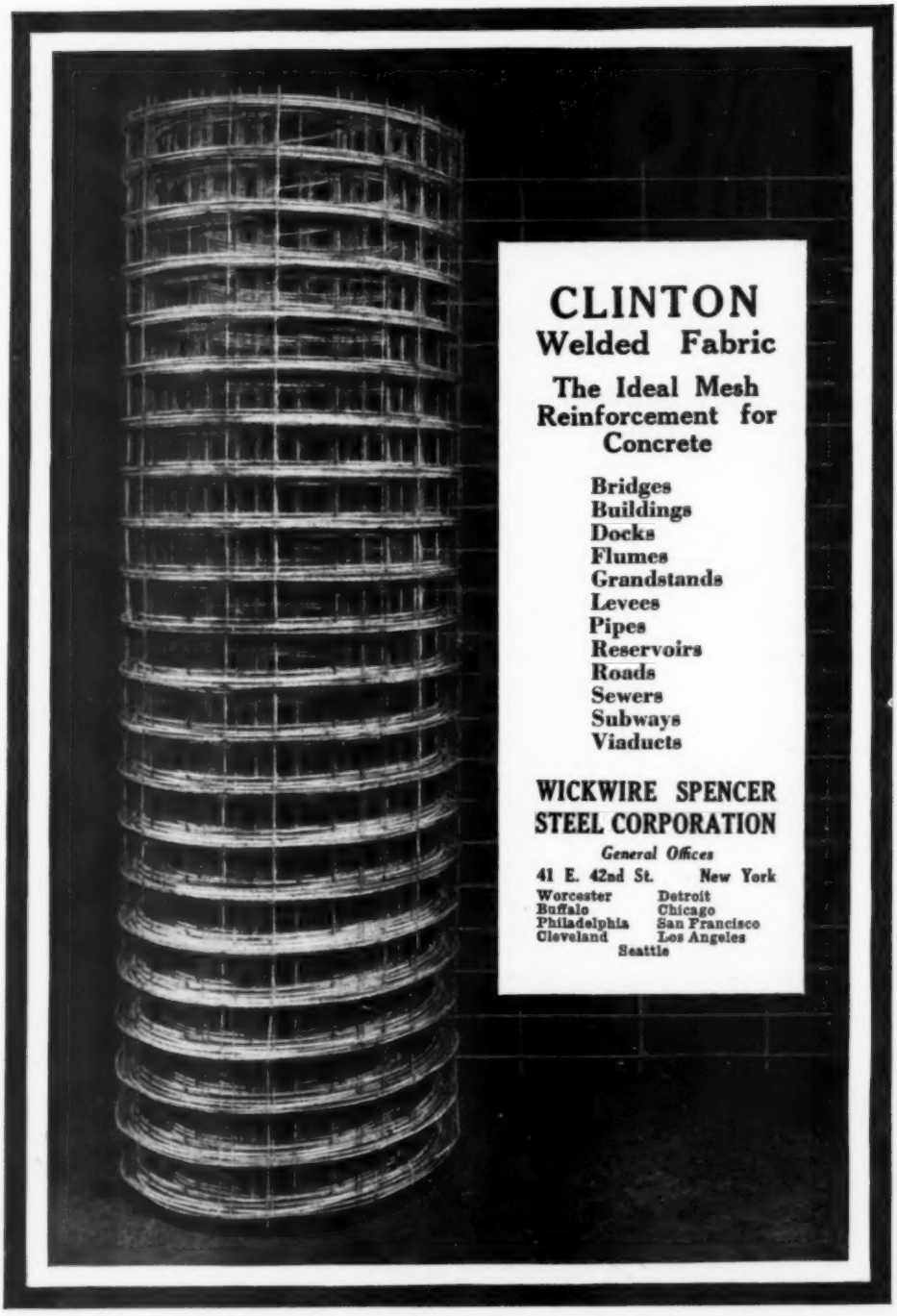
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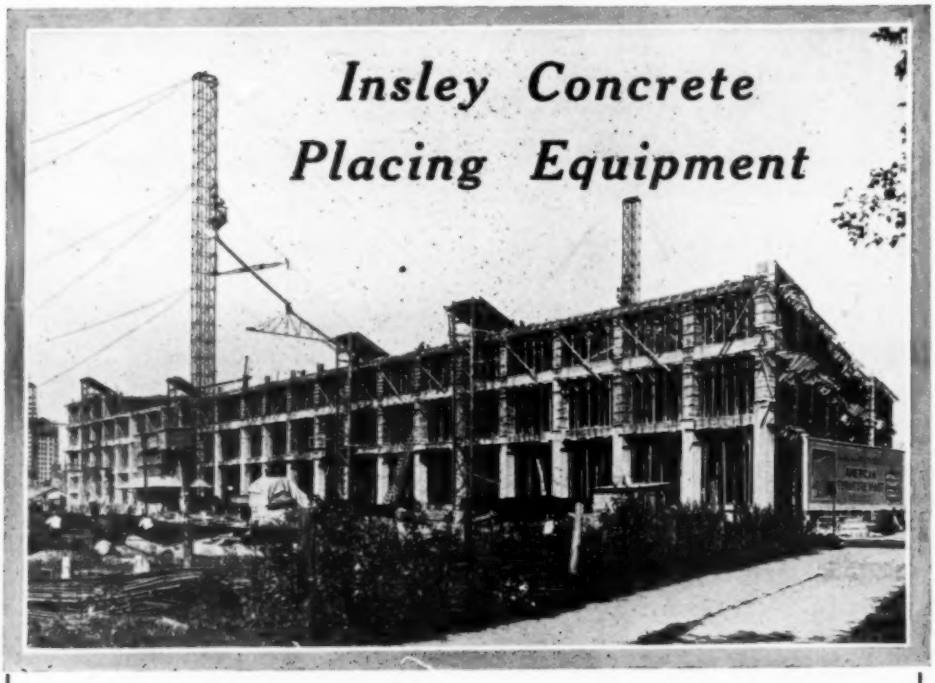

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DOORS, METAL (KALAMEIN)

Friedrich Co., E. H. Holyoke, Mass.
Penn Metal Co., Boston, Mass.
Riester & Thesmacher Co., Cleveland, Ohio.
Sykes Co., Chicago, Ill.
Thorp Fireproof Door Co., Minneapolis, Minn.

DOORS AND SHUTTERS, STEEL ROLLING

Cornell Iron Works, Inc., New York.
Kinnear Mfg. Co., Columbus, O.
Variety Fire Door Co., Chicago, Ill.
Wilson Corp., J. G., New York.

DRAFTING MACHINES

Universal Drafting Machine Co., Cleveland. O.

DRAINAGE TOOLS

*Oliver Ames & Sons Corp., North Easton, Mass.
*Ames Shovel & Tool Co., Boston, Mass.
*Geo. Griffiths Co., Cheltenham, Pa.
*The H. M. Myers Co., Beaver Falls, Pa.
*T. Rowland's Sons, Inc., Cheltenham, Pa.
*St. Louis Shovel Co., Plant, St. Louis, Mo.
*Wright Shovel Co., Anderson, Ind.

DREDGES

*Bay City Dredge Works, Bay City, Mich.
*Michigan Dredge Co., Bay City, Mich.
*Osgood Co., The, Marion, O.
American Steel Dredge Co., Fort Wayne, Ind.
Bucyrus Co., South Milwaukee, Wis.
Ellicott Machine Corp'n, Baltimore, Md.
Erie Steam Shovel Co., Erie, Pa.
Hayward Co., New York.
Lidgerwood Mfg. Co., New York.
Marion Steam Shovel Co., Marion, O.
Stockton Iron Works, Stockton, Cal.
Street Bros. Machine Works, Chattanooga, Tenn.
Superior Iron Works, Superior, Wis.
Vulcan Iron Works, Jersey City, N. J.

DREDGES, DIPPER

*Bay City Dredge Works, Bay City, Mich.
*Osgood Co., Marion, O.
American Steel Dredge Co., Fort Wayne, Ind.
Austin Machinery Corp'n, Muskegon, Mich.
Bucyrus Co., South Milwaukee, Wis.
Fairbanks Steam Shovel Co., Marion, O.
Marion Steam Shovel Co., Marion. O.

DREDGES, HYDRAULIC

Bucyrus Co., South Milwaukee, Wis.
Ellicott Mach. Corp., Baltimore, Md.
Fairbanks Steam Shovel Co., Marion, O.
Marion Steam Shovel Co., Marion, O.
Morris Machine Works, Baldwinsville, N. Y.

DREDGING PUMPS AND ACCESSORIES

Erie Pump & Engine Wks., Medina, N. Y.

DRILLS, AIR AND ROCK

*Dallett Co., The, Philadelphia, Pa.
*Denver Rock Drill Mfg. Co., Denver, Colo.
*McKiernan-Terry Drill Co., New York.
*Wood Drill Wks., Paterson, N. J.
Chicago Pneumatic Tool Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, Ohio.
Cleveland Rock Drill Co., Cleveland, Ohio.
Helwig Mfg. Co., St. Paul, Minn.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., New York.
Sullivan Machinery Co., Chicago, Ill.

DRILLS, CORE

*McKiernan-Terry Drill Co., New York.
Dobbins Core Drill Co., Inc., New York.
Ingersoll-Rand Co., New York.
Standard Diamond Drill Co., Chicago, Ill.
Sullivan Mach'y Co., Chicago, Ill.

DRILLS, HAMMER (PNEUMATIC)

*Denver Rock Drill Mfg. Co., Denver, Colo.
*McKiernan-Terry Drill Co., New York.
*Wood Drill Works, Paterson, N. J.
Chicago Pneumatic Tool Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Cleveland Rock Drill Co., Cleveland, O.
Helwig Mfg. Co., St. Paul, Minn.
Ingersoll-Rand Co., New York.
Sullivan Machinery Co., Chicago, Ill.

DRILLS FOR WELLS AND BLAST HOLES
(See Well Drilling Machinery)

DRUMS, HOLDING

*Blaw-Knox Co., Pittsburgh, Pa.
Clyde Iron Wks. Sales Co., Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Hayward Co., New York.
Monighan Machine Co., Chicago, Ill.

DRYERS, ASPHALT AND CEMENT

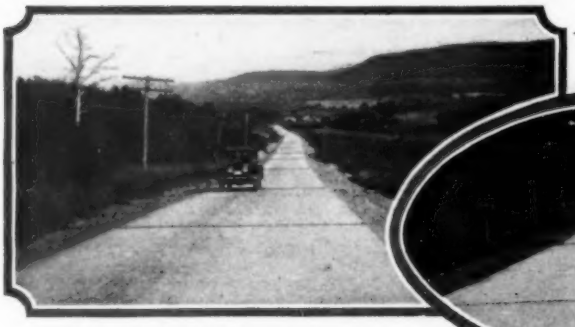
*East Iron & Machine Co., Lima, Ohio.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Blower Co., Detroit, Mich.
American Process Co., New York.
Atlas Dryer Co., Cleveland, O.
Bartlett & Snow Co., C. O., Cleveland, O.
Cummer & Son Co., F. D., Cleveland, O.
Ruggles-Coles Eng. Co., New York.

DRYERS, SAND AND GRAVEL

*Aeroil Burner Co., Union Hill, N. J.
*Littleford Bros., Cincinnati, Ohio.
Bartlett & Snow Co., C. O., Cleveland, Ohio.
Chase & Lyman, Boston, Mass.

DUMP BODIES FOR MOTOR TRUCKS

*Heil Company, Milwaukee, Wis.
*Insley Mfg. Co., Indianapolis, Ind.
*International Motor Co., New York.
*Littleford Bros., Cincinnati, O.
*Stewart Iron Wks. Co., Cincinnati, Ohio
Archer Iron Works, Chicago, Ill.
Columbia Body Corp., Columbia, Pa.
Columbian Steel Tank Co., Kansas City, Mo.
Easton Car & Const'n Co., Easton, Pa.
Griscom-Russell Co., New York.
Jennings Automatic Dump Body, Roanoke, Va.
Lee Trailer & Body Co., Chicago, Ill.



Freehold—Matawan Road, New Jersey

Sunbury Paxinos Road, Pennsylvania

The road that stands the gaff!

Many types of road-construction have been tried out during the past fifteen years. Test highways have been laid and subjected to every conceivable stress of traffic and weather-conditions.

Foremost among all hard-surface types, its economy proven by years of performance, is the properly designed and correctly constructed concrete road, with Carey Elastite Expansion Joints at regular intervals to absorb expansion stresses. Such roads have stood up with minimum maintenance costs under increasing weight of traffic.

Over 40,000 miles of concrete highway are completed, and concrete highway programs are expanding. The next few years will see a tremendous increase in concrete road construction.

But there will always be enough Carey Elastite Expansion Joint ready for prompt shipment to the job. Carey facilities for producing expansion joint are always well ahead of maximum requirements for concrete road construction in the United States.

Mullica Hill—Matawan Road, New Jersey

THE PHILIP CAREY COMPANY

9 Wayne Avenue, Lockland, Cincinnati, Ohio

Carey Elastite

NAME REG. U.S. Patent Office

EXPANSION JOINT PROVED AND ACCEPTED

Send for this complete treatise on the use of expansion joint in concrete constructions and sample of Carey Elastite Expansion Joint.

Elastite Expansion Joint is an elastic resilient material composed of two sheets of asphalt-saturated felt between which is "sandwiched" a body of carefully refined asphaltic compound.

18-41

Mandt Body Co., Keokuk, Iowa.
Pechstein Iron Works, Keokuk, Iowa.
Van Dorn Iron Wks., Cleveland, Ohio.
Wood Hydr. Hoist & Body Co., Detroit, Mich.
(Horizontal Hydr. Hoist Co., Detroit, Mich.)

DUMP CARTS AND WAGONS, HORSE DRAWN

*Austin-Western Road Machy. Co., Chicago, Ill.
*Russell Grader Mfg. Co., Minneapolis, Minn.
*Stockland Road Mach'y Co., Minneapolis, Minn.
Acme Road Machinery Co., Frankfort, N. Y.
Acme Wagon Co., Emigsville, Pa.
Austin Mfg. Co., Chicago, Ill.
Columbia Body Corp., Columbia, Pa.
Convertible Wagon-Trailers, Inc., Buffalo, N. Y.
Eagle Wagon Works, Auburn, N. Y.
Gilbert Mfg. Co., Aberdeen, S. D.
Holsbog & Bro., Geo. H., Jeffersonville, Ind.
Little Red Wagon Co., Omaha, Neb.
Watson Products Corp., Canastota, N. Y.
Western Wheeled Scraper Co., Aurora, Ill.

DUST LAYING (CALCIUM CHLORIDE)

*Dow Chemical Co, Midland, Mich.
*Solvay Process Co., New York
Carbondale Calcium Co., Carbondale, Pa.

DYNAMITE (See Explosives)

EJECTORS, SEWAGE (See Sewage Ejectors)

ELECTRIC GENERATORS AND MOTORS

Louis Allis Co., Milwaukee, Wis.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Crocker-Wheeler Co., Ampere, N. J.
Fairbanks, Morse & Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Idea Elec. & Mfg. Co., Mansfield, O.
Lincoln Electric Co., Cleveland, O.
Robbins & Myers Co., Springfield, O.
Triumph Electric Co., Cincinnati, O.
Wagner Elec. Mfg. Co., St. Louis, Mo.
Western Electric Co., New York.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

ELECTRIC LAMPS

General Electric Co., Schenectady, N. Y.
Westinghouse Lamp Co., New York.

ELECTRIC LIGHTING PLANTS

*Climax Engineering Co., Clinton, Ia.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Universal Motor Co., Oshkosh, Wis.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.
Western Electric Co., New York.

ELECTRIC SUPPLIES, METERS, ETC.

General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

ELECTRIC TRANSFORMERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Kuhlman Electric Co., Bay City, Mich.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

ELECTRIC WIRES AND CABLES. (See "Wire and Cable")

ELEVATORS, BUCKET

*Atlas Eng. Co., Milwaukee, Wis.
*Austin-Western Road Machy. Co., Chicago, Ill.
*Good Roads Mach'y Co., Kennett Square, Pa.
*Haiss Mfg. Co., Geo., New York.
*Littleford Bros., Cincinnati, Ohio.
*Russell Grader Mfg. Co., Minneapolis, Minn.
*Spears-Wells Mach'y Co., Oakland, Cal.
*Universal Road Machinery Co., Kingston, N. Y.
Austin Mfg. Co., Chicago, Ill.
Bartlett & Snow Co., C. O., Cleveland, O.
Chain Belt Co., Milwaukee, Wis.
Fairfield Engineering Co., Lancaster, Ohio.
Gifford-Wood Co., Hudson, N. Y.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Olson & Co., Sam'l, Chicago, Ill.
Robins Conv. Belt Co., New York.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.
Worthington Pump & Mchy. Corp., New York.

ELEVATORS, PASSENGER, FREIGHT, ETC.

Amer. Elevator & Mach. Co., Louisville, Ky.
Atlantic Elevator Co., Inc., Philadelphia, Pa.
Bay State Elevator Co., Springfield, Mass.
Haughton Elev. & Mach. Co., Toledo, Ohio.
Kaestner & Hecht Co., Chicago, Ill.
Llewellyn Iron Works, Los Angeles, Cal.
Montgomery Elevator Co., Moline, Ill.
Otis Elevator Co., New York.
Ridgeway & Son Co., C., Coatesville, Pa.
See Elec. Elevator Co., A. B., New York.
Speidel, J. G., Reading, Pa.
Warner Elevator Mfg. Co., Cincinnati, O.
Warsaw Elevator Co., Warsaw, N. Y.

ENGINES, GAS AND GASOLINE

*Climax Engineering Co., Clinton, Ia.
*Domestic Engine & Pump Co., Shippensburg, Pa.
*Hercules Corpn., Evansport, Ind.
*Holt Mfg. Co., Peoria, Ill.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Buda Co., Harvey, Ill.
C. H. & E. Manufacturing Co., Milwaukee, Wis.
Charter Gas Eng. Co., Sterling, Ill.
Chicago Pneumatic Tool Co., New York.
Evinrude Motor Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Chicago, Ill.
Foos Gas Engine Co., Springfield, Ohio.
Fuller & Johnson Mfg. Co., Madison, Wis.
Gade Bros. Mfg. Co., Iowa Falls, Iowa.
John Lauson Mfg. Co., New Holstein, Wis.
Le Roi Co., Milwaukee, Wis.
"New-Way" Motor Co., Lansing, Mich.
Novo Engine Co., Lansing, Mich.
Universal Motor Co., Oshkosh, Wis.
Weber Engine Co., Kansas City, Mo.
Wellman-Seaver-Morgan Co., Cleveland, O.
Worthington Pump & Mchy. Corp., New York.

ENGINES, KEROSENE

*Climax Engineering Co., Clinton, Iowa

ENGINES, OIL

DIESEL

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Busch-Sulzer Bros.-Diesel Eng. Co., St. Louis, Mo.
Fulton Iron Works Co., St. Louis, Mo.
Hadfield-Penfield Steel Co., Bucyrus, Ohio.
McIntosh & Seymour Corp., Auburn, N. Y.
Nordberg Mfg. Co., Milwaukee, Wis.
Western Machy. Co., Los Angeles, Cal.

SEMI-DIESEL

Anderson Fdry. & Mach. Co., Anderson, Ind.
Bessemer Gas Eng. Co., Grove City, Pa.
Buckeye Machinery Co., Lima, O.
Charter Gas Eng. Co., Sterling, Ill.
Chicago Pneumatic Tool Co., New York.
De La Vergne Machine Co., New York.
Fairbanks, Morse & Co., Chicago, Ill.
Foos Gas Engine Co., Springfield, Ohio.
Ingersoll-Rand Co., New York.
Midwest Engine Co., Indianapolis, Ind.
Muncie Oil Eng. Co., Muncie, Ind.
Nordberg Mfg. Co., Milwaukee, Wis.
St. Mary's Oil Eng. Co., St. Charles, Mo.
Stover Mfg. & Engine Co., Freeport, Ill.
Taylor Machine Co., Cleveland, O.
Weber Engine Co., Kansas City, Mo.
Worthington Pump & Mchy. Corp., New York.

ENGINES, PUMPING

*Climax Engineering Co., Clinton, Ia.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Hooven, Owens, Rentschler Co., Hamilton, O.
Murray Iron Wks., Burlington, Ia.
Norberg Mfg. Co., Milwaukee, Wis.
Worthington Pump & Mchy. Corp., New York.

ENGINES, STEAM

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Dake Engine Co., Grand Haven, Mich.
Erie-Ball Engine Co., Pittsburgh, Pa.
Erie Pump & Engine Co., Medina, N. Y.

For Heating and Applying under Pressure all varieties of Bituminous Materials, Hot or Cold, for Road Construction, Maintenance of Dust Laying.

Heat and volume under instant control of operator. Positive pressure produced by the Kinney Pump.

Auto Heater and Distributor PATENT COMBINATION

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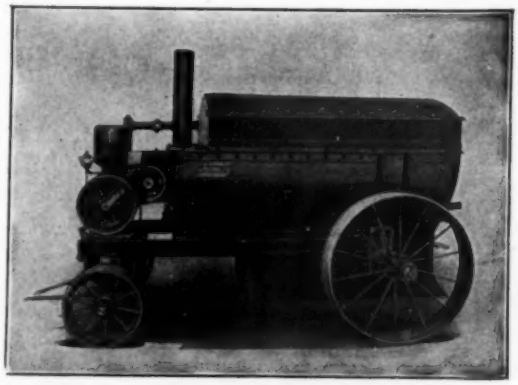
HANDY HEATER and SPRAYER

Especially adapted for Road maintenance, construction and general repair work. Contents constantly agitated while heating.

No burning or coking of materials, Pump, Piping, Hose, Nozzles, AutomaticallyHeated.

No Steam Required.



Kinney Manufacturing Company

3529 Washington Street
BOSTON, MASSACHUSETTS

BRANCHES:

NEW YORK PHILADELPHIA CHICAGO SAN FRANCISCO HOUSTON KANSAS CITY

Filer-Stowell Co., Milwaukee, Wis.
Hardie-Tynes Mfg. Co., Birmingham, Ala.
Leffel Co., J., Springfield, O.
Morris Machine Works, Baldwinsville, N. Y.
Murray Iron Works Co., Burlington, Ia.
Norberg Mfg. Co., Milwaukee, Wis.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Vilter Mfg. Co., Milwaukee, Wis.

EXCAVATING MACHINERY. (See Names Under Excavators, also Steam Shovels)

EXCAVATORS, CABLEWAY

Bucyrus Co., South Milwaukee, Wis.
Lidgerwood Mfg. Co., New York.

EXCAVATORS, DITCH AND TRENCH

*Bay City Dredge Wks., Bay City, Mich.
*Insley Mfg. Co., Indianapolis, Ind.
*Keystone Driller Co., Beaver Falls, Pa.
*Osgood Co., The, Marion, O.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
*Russell Grader Mfg. Co., Minneapolis, Minn.
American Hoist & Derrick Co., St. Paul, Minn.
Austin Machinery Corp'n, Muskegon, Mich.
Clyde Iron Wks. Sales Co., Duluth, Minn.
Byers Machine Co., Ravenna, Ohio.
Buckeye Traction Ditcher Co., Findlay, Ohio.
Bucyrus Co., South Milwaukee, Wis.
Economy Excavator Co., Iowa Falls, Ia.
Erie Steam Shovel Co., Erie, Pa.
Fairbanks Steam Shovel Co., Marion, O.
Hayward Co., The, New York City.
Marion Steam Shovel Co., Marion, O.
Monighan Machine Co., Chicago, Ill.
Parsons Co., Newton, Ia.
Topping Machy. Co., Chas. T. Dayton, O.

EXCAVATORS, DRAG-LINE

*Bay City Dredge Works, Bay City, Mich.
*Green, L. P., Chicago, Ill.
*Osgood Co., The, Marion, O.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
*Sauerman Bros., Chicago, Ill.
Austin Machinery Corp'n, Muskegon, Mich.
Galion Iron Works & Mfg. Co., Galion, Ohio
Browning Co., Cleveland, O.
Bucyrus Co., South Milwaukee, Wis.
Byers Machine Co., Ravenna, Ohio.
Clyde Iron Wks. Sales Co., Duluth, Minn.
Economy Excavator Co., Iowa Falls, Ia.
Erie Steam Shovel Co., Erie, Pa.
Gade Excavator Works, C. L., Iowa Falls, Iowa.
Hayward Co., New York.
Industrial Works, Bay City, Mich.
Link-Belt Co., Chicago, Ill.
Marion Steam Shovel Co., Marion, O.
Monighan Machine Co., Chicago, Ill.
Parsons Co., Newton, Ia.
Smith Co., T. L., Milwaukee, Wis.

EXPANDED METAL

*Truscon Steel Co., Youngstown, O.
Berger Mfg. Co., Canton, O.
Consolidated Expanded Metal Co., Braddock, Pa.
Kalman Steel Co., Chicago, Ill.
Northwestern Expanded Metal Co., Chicago, Ill.
Youngstown Pressed Steel Co., Warren, O.

EXPANSION JOINT MATERIAL

*Barber Asphalt Co., Philadelphia, Pa.
*Barrett Co., New York
*Carey Co., Philip, Cincinnati, Ohio.
*Texas Company, New York.
*Truscon Steel Co., Youngstown, O.
*Waring-Underwood Co., Philadelphia, Pa.
Hoosier Asphalt Co., Alexandria, Ind.
Pioneer Asphalt Co., Lawrenceville, Ill.
Servicised Product Corp., Chicago, Ill.

EXPLOSIVES

Atlas Powder Co., Wilmington, Del.
Du Pont de Nemours & Co., E.I., Wilmington, Del.
Giant Powder Co., Cons., San Francisco, Cal.
Grasselli Powder Co., Cleveland, O.
Hercules Powder Co., Wilmington, Del.

FENCING

*Stewart Iron Works Co., Cincinnati, Ohio
*Wickwire Spencer Steel Corp., New York.
Adrian Wire Fence Co., Adrian, Mich.
American Steel & Wire Co., Chicago, Ill.
Anchor Post Iron Works, New York.
Cyclone Fence Co., Waukegan, Ill.
Frost-Superior Fence Co., Cleveland, O.
Indiana Steel & Wire Co., Muncie, Ind.
Nitselman Bros., Muncie, Ind.
Michigan Wire Fence Co., Adrian, Mich.
Page Steel & Wire Prod. Corp., Bridgeport, Conn.
Pittsburgh Steel Co., Pittsburgh, Pa.
Texas Cyclone Fence Co., Fort Worth, Tex.
Youngstown Sheet & Tube Co., Youngstown, O.

FILING EQUIPMENT, STEEL

Art Metal Constr. Co., Jamestown, N. Y.
Berger Mfg. Co., Canton, O.
General Fireproofing Co., Youngstown, O.
Van Dorn Iron Works, Cleveland, O.

FILTERS, OIL

Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Wayne Tank & Pump Co., Ft. Wayne, Ind.

FILTERS, WATER

American Water Softener Co., Philadelphia, Pa.
Graver Corporation, E. Chicago, Ind.
International Filter Co., Chicago, Ill.
Norwood Engineering Co., Florence, Mass.
Roberts Filter Co., Darby, Pa.
Scaife & Sons Co., W. B., Pittsburgh, Pa.

FIRE ALARM SYSTEMS

Gamewell Co., Newton Upper Falls, Mass.

FIRE ALARM SIRENS

Erick Elec. Siren Co., St. Paul, Minn.
Federal Sign System, Chicago, Ill.
Hendrie & Bolthoff Mfg. & Sup. Co., Denver, Col.
Interstate Machine Prod. Co., Rochester, N. Y.
Sireno Co., Stapleton, N. Y.
Union Water Meter Co., Worcester, Mass.

FIRE APPARATUS, MOTOR

*International Motor Co., New York.
Ahrens-Fox Fire Engine Co., Cincinnati, O.
American-La France Fire Eng. Co., Elmira, N. Y.
Brockway Motor Fire App. Co., Cortlandt, N. Y.
Foamite-Childs Corp., Utica, N. Y.
Hale Fire Pump Co., Conshohocken, Pa.
Northern Fire Apparatus Co., Minneapolis, Minn.
Obenchain-Boyer Co., Logansport, Ind.
Pirsch & Sons Co., Peter, Kenosha, Wis.
Prospect Fire Engine Co., Prospect, O.
Seagrave Co., Columbus, O.
Stutz Fire Engine Co., Indianapolis, Ind.
Waterous Fire Engine Works, St. Paul, Minn.

FIRE EXTINGUISHERS, CHEMICAL

American-La France Fire Eng. Co., Elmira, N. Y.
Buffalo Fire Appliance Corp., Buffalo, N. Y.
Cross Mfg. Co., C. J., Inc., New York.
Foamite-Childs Co., Utica, N. Y.
Pyrene Mfg. Co., Newark, N. J.

FIRE HOSE (See Hose, Fire)

FIREPROOF BUILDING MATERIAL

*Truscon Steel Co., Youngstown, O.
Berger Mfg. Co., Canton, O.
Detroit Steel Prod. Co., Detroit, Mich.
General Fireproofing Co., Youngstown, O.
Kalman Steel Co., Chicago, Ill.
Keasbey & Mattison Co., Ambler, Pa.
Kinnear Mfg. Co., Columbus, O.
National Fireproofing Co., Pittsburgh, Pa.
United States Gypsum Co., Chicago, Ill.
Youngstown Pressed Steel Co., Warren, O.

FIRST AID EQUIPMENT

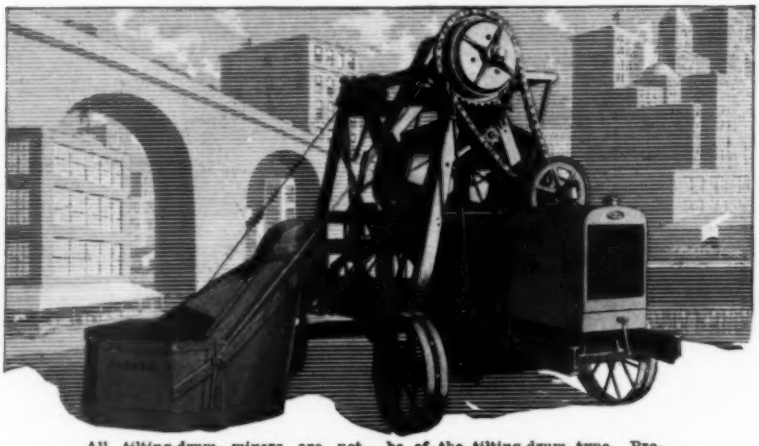
American-La France Fire Eng. Co., Elmira, N. Y.

FLEXIBLE JOINTS

*Century Foundry Co., New York.
*U. S. C. I. Pipe & Fdry Co., Burlington, N. J.
Coldwell-Wilcox Co., Newburgh, N. Y.
Crane Co., Chicago, Ill.
United Lead Company, New York.

FLOORING, COMPOSITION

*Barber Asphalt Co., Philadelphia, Pa.
*Barrett Co., New York



All tilting-drum mixers are not Jaegers. The "Jaeger" is far superior to any mixer made and should not be confused with inferior machines even though they be of the tilting-drum type. Protect yourself by getting the "genuine Jaeger." Look for the name on the drum and the flat spots inside!

Back of Every JAEGER~
The Most Imposing Concrete Structures of the Nation

THE world's tallest concrete office buildings—the greatest concrete stadiums—palatial hotels—acres of busy concrete factories—beautiful homes—and wide, winding concrete boulevards! These form the milestones of Jaeger Progress and mark the efficiency of every Jaeger Concrete Mixer.

A Jaeger means to you the greatest value you can buy in a Concrete Mixer. It is not just a concrete mixing machine—it is the Original Tilting-Drum Mixer—built for service in every bolt and screw—in every part and parcel of material that goes into it.

From towering sky-scrapers to modest garage or garden walk, Jaegers have served the concrete industry faithfully. They afford you downright dependable production year after year. They cut your building costs enormously—make possible **estimates that "get the business at a profit."**

Before you buy another concrete mixer, look around. Notice how many Jaegers are in daily use. Ask their owners for their records and find out the tremendous amount of work they handle. Then you'll find the answer and the reasons for it—**low cost, thoroughly mixed, high speed concrete production for every working hour.**

Jaeger Mixers make up a complete line of 30 concrete mixing outfits ranging from 3 to 14 cu. ft. per batch of mixed concrete. One of these outfits is what you need. Write us today for our illustrated catalog and start the New Year with a Jaeger "Mix-a-Minute" to turn out profits for you.

Stocks carried in all principal cities. Write us for the name of the distributor nearest you.

THE JAEGER MACHINE CO.
701 Dublin Road **Columbus, Ohio.**

JAEGER
The Original Tilting Drum Mixer

Am. Mason Safety Tread Co., Lowell, Mass.
Johns-Manville, Inc., New York.
Marine Decking & Supply Co., Phila., Pa.
Muller, Franklyn R., & Co., Waukegan, Ill.

FLOORS, WOOD BLOCK

*Barrett Co., New York.
Carter Bloxonend Flooring Co., Kansas City, Mo.
Jennison-Wright Co., Toledo, O.
Midland Creosoting Co., Toledo, O.
Republic Creosoting Co., Indianapolis, Ind.
Sou. Wood Preserving Co., Atlanta, Ga.
Wyckoff Pipe & Creosoting Co., New York.

FLUSH TANKS

Pacific Flush Tank Co., Chicago, Ill.

FLUSHERS, STREET. (See Street Flushers and Sprinklers.)

FORD AND FORDSON EQUIPMENT

AIR COMPRESSORS FOR FORDSONS

*Curtis Pneumatic Machinery Co., St. Louis, Mo.
Schramm, Inc., Westchester, Pa.

AIR COMPRESSORS FOR FORD TRUCKS

*Domestic Engine & Pump Co., Shippensburg, Pa.
Schramm, Inc., Westchester, Pa.

CONCRETE MIXERS ON FORD TRUCKS

*American Cement Machine Co., Keokuk, Iowa
Archer Iron Works, Chicago, Ill.
Milwaukee Concrete Mixer Co., Milwaukee, Wis.

DUMP BODIES FOR FORD TRUCKS

*Heil Co., Milwaukee, Wis.
*Stewart Iron Works Co., Cincinnati, Ohio
American Production & Trading Co., Chicago, Ill.
Anthony Co., Streator, Ill.
Archer Iron Wks., Chicago, Ill.
Columbian Steel Tank Co., Kansas City, Mo.
Eagle Wagon Works, Auburn, N. Y.
Easton Car & Const'n Co., Easton, Pa.
Griscom-Russell, New York.
Hughes-Keenan Co., Mansfield, Ohio.
Jennings Auto. Dump Body Co., Roanoke, Va.
Lee Trailer & Body Co., Chicago, Ill.
Mandt Co., Keokuk, Iowa.
Martin-Parry Corp., York, Pa.
N. Y. Cent. Iron Wks. Co., Inc., Hagerstown, Md.
Pechstein Iron Works, Keokuk, Iowa.
Superior Boiler Works, Marion, Ind.
Thompson Mfg. Co., Williston, S. C.
Van Dorn Iron Works, Cleveland, Ohio.
Wood Hydr. Hoist & Body Co., Detroit, Mich.

FORD MOTOR PUMPER

Barton Products Co., Jackson, Mich.

FORD PLOWS

Roderick Lean Mfg. Co., Mansfield, Ohio.

FORD REPLACEMENT UNITS (AXLES AND TRANSMISSIONS)

*Hinckley Motors, Inc., Detroit, Mich.
*Warford Corpn., New York
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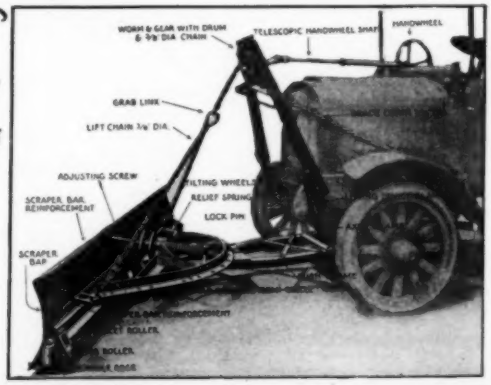

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*Pittsburgh Meter Co., Pittsburgh, Pa.
*Union Water Meter Co., Worcester, Mass.
Buffalo Meter Co., Buffalo, N. Y.
Federal Meter Co., Brooklyn, N. Y.
Gamon Meter Co., Newark, N. J.
Hersey Mfg. Co., Boston, Mass.
National Meter Co., New York.
Thomson Meter Co., Brooklyn, N. Y.
Worthington Pump & Mchy. Corp., New York.

METERS, WATER (VENTURI TYPE)
Builders Iron Foundry, Providence, R. I.
Simplex Valve & Meter Co., Philadelphia, Pa.

MIXERS, CONCRETE (See Concrete Mixers)

MIXERS, GROUT
*American Cement Mchy. Co., Inc., Keokuk, Ia.
Kent Machine Co., Kent, O.
Lakewood Engineering Co., Cleveland, O.
Union Iron Works, Inc., Hoboken, N. J.

MIXERS, HOT
*Barber Asphalt Co., Philadelphia, Pa.
*Koehring Co., Milwaukee, Wis.
Austin Machinery Corp'n, Muskegon, Mich.

MIXERS, MORTAR
*American Cement Mchy. Co., Inc., Keokuk, Ia.
*Blaw-Knox Co., Pittsburgh, Pa.
*Construction Machinery Co., Waterloo, Ia.
*Ransome Concrete Mchy. Co., Dunellen, N. J.
Austin Machinery Corp'n, Muskegon, Mich.
C. H. & E. Manufacturing Co., Milwaukee, Wi
Kent Machine Co., Kent, O.
Knickerbocker Co., Jackson, Mich.
Lansing Co., Lansing, Mich.
Lakewood Engineering Co., Cleveland, Ohio.
Marsh-Capron Co., Chicago, Ill.
Smith Co., T. L., Milwaukee, Wis.

MOTORCYCLES
Ace Motor Corp., Philadelphia, Pa.
Cleveland Motorcycle Co., Cleveland, Ohio.
Excelsior Motor Mfg. & Supply Co., Chicago, Ill.
Harley-Davidson Motor Co., Milwaukee, Wis.
Indian Motocycle Co., Springfield, Mass.

MOTORS, ELECTRIC (See Electric Generators and Motors)

MOTORS, GASOLINE
*Climax Engineering Co., Clinton, Iowa
*Hinckley Motors, Inc., Detroit, Mich.
Buda Co., Harvey, Ill.
Continental Motors Corp., Detroit, Mich.
Waukesha Motor Co., Waukesha, Wis.
Wisconsin Motor Mfg. Co., Milwaukee, Wis.

MOTOR TRUCKS
*Ford Motor Co., Detroit, Mich.
*General Motors Truck Co., Pontiac, Mich.
*International Motor Co., New York.
*United Motor Products Co., Grand Rapids, Mich.
Acme Motor Truck Co., Cadillac, Mich.
Atterbury Motor Car Co., Buffalo, N. Y.
Autocar Co., Ardmore, Pa.
Bessemer Motor Truck Co., Grove City, Pa.
Brockway Motor Truck Co., Cortland, N. Y.
Clydesdale Motor Truck Co., Clyde, O.
Denby Motor Truck Co., Detroit, Mich.

KEOKUK STREETS STAND TEST *of* TIME

CAMERON, JOYCE & Co.
RAILROAD AND GENERAL CONTRACTORS

October 28,

The Standard Oil Company of Indiana,
Chicago, Illinois.

Gentlemen:-

We have used your Stan-O-Lind Paving Asphalt in the City of Keokuk for twelve years and have had good results with all of the paving on which we have used same.

We have paved Upper Main Street, South 8th Street and Exchange Street from fourth to fifth and those streets are in very good condition today.

Yours very truly,

CAMERON, JOYCE AND COMPANY

By Thos H Joyce
President

THJ:V

Scene on Upper Main Street, Keokuk, Iowa, where Stanolind Paving Filler was applied many years ago. The filler has given excellent results on this street.

Good after Twelve Years Service

OUT in Keokuk, Iowa, Stanolind Paving Asphalt has been used for the past twelve years and in every instance it has given entire satisfaction. The picture above shows a section of Upper Main street (brick with Stanolind Asphalt Filler). This same product has given equally as satisfactory results at hundreds of other points throughout the country.

Stanolind Paving Asphalt, properly used, will give greater service and satisfaction, per dollar cost, than any other high class paving that can be used. This fact has been demonstrated repeatedly.

And at the time initial cost is considered, thought should also be given to the maintenance cost. In the case of Stanolind Paving Asphalt the latter is surprisingly low, as streets paved with it, in many cases, serve ten years without requiring any repairs whatever.

Ask for this free booklet

Check the record of any street constructed of Stanolind Paving Asphalt; the traffic it carries; the cost of construction and its upkeep, then compare these figures with like figures on any other type of paving. You'll see then why Stanolind Paving Asphalt has constantly grown in popularity with those who strive for the best roads. It is a plain case of dollars and sense.

If you are interested in formulating a constructive street or road building program for your town, city or county, we invite you to communicate with our staff of efficient, experienced road engineers. They will be pleased to co-operate with you and give you the benefit of their advice.

This service is rendered free of charge and it places you under no obligation whatever to us.

STANDARD OIL COMPANY
(INDIANA)

General Offices: 904 S. Michigan Ave., CHICAGO, ILLINOIS

ILLINOIS	INDIANA	IOWA	S DAKOTA	N. DAKOTA	MINNESOTA	MISSOURI
Chicago	Evansville	Davenport	Huron	Fargo	Duluth	Kansas City
Decatur	Indianapolis	Des Moines	MICHIGAN	Minot	Mankato	St. Joseph
Joliet	South Bend	Mason City	Detroit	WISCONSIN	Minneapolis	St. Louis
Peoria	KANSAS	Sioux City	Grand Rapids	La Crosse		
Quincy	Wichita		Saginaw	Milwaukee		

Diamond T. Motor Car Co., Chicago, Ill.
Duplex Truck Co., Lansing, Mich.
Federal Motor Truck Co., Detroit, Mich.
Four Wheel Drive Auto Co., Clintonville, Wis.
Garford Motor Truck Co., Lima, O.
Gramm Bernstein Truck Corp'n, Lima, O.
The Hug Co., Highland, Ill.
Indiana Truck Corp'n., Marion, Ind.
International Harvester Co., Chicago, Ill.
Kelly Springfield Motor Truck Co., Springfield, O.
Kissel Motor Car Co., Hartford, Wis.
Larrabee-Deyo Motor Tr. Co., Binghamton, N. Y.
Nash Motors Co., Kenosha, Wis.
Pierce-Arrow Motor Car Co., Buffalo, N. Y.
Republic Motor Truck Co., Alma, Mich.
Service Motor Truck Co., Wabash, Ind.
Sterling Motor Truck Co., Milwaukee, Wis.
Stewart Motor Copr'n, Buffalo, N. Y.
Traffic Motor Truck Co., St. Louis, Mo.
Transport Truck Co., Mt. Pleasant, Mich.
U. S. Motor Truck Co., Cincinnati, O.
White Co., Cleveland, Ohio.

MOULDS, CONCRETE

*Blaw Knox Co., Pittsburgh, Pa.

MUCKING MACHINES

Hoar Shovel Co., Duluth, Minn.

NUMBERS, HOUSE (See "House Numbers")

OAKUM

Wall Rope Works, Beverly, N. J.

OILS, ROAD

*Barber Asphalt Co., Philadelphia, Pa.
*Barrett Co., New York.
*Standard Oil Co., (Indiana), Chicago, Ill.
*Texas Company, New York.
Atlantic Refining & Asphalt Corp'n, Philadelphia
Headley Good Roads Co., Philadelphia, Pa.
Pioneer Asphalt Co., Lawrenceville, Ill.
Standard Oil Co., (La.) New Orleans, La.
Standard Oil Co., (N. J.), Newark, N. J.
Standard Oil Co. (N. Y.), New York.

OXY-ACETYLENE APPARATUS

Oxweld Acetylene Co., Newark, N. J.

OXYGEN

Linde Air Products Co., New York.

PACKING, WATER PIPE

*Union Water Meter Co., Worcester, Mass.
Leadite Co., The, Philadelphia, Pa.
United Lead Company, New York.

PAINT GUNS

Spray Painting & Finishing Equipment Sales Co., Boston, Mass.

PAINTS, METAL PROTECTION

*Barber Asphalt Co., Philadelphia, Pa.
*Barrett Co., New York.
*Carey Co., Philip, Cincinnati, Ohio.
*Dixon Crucible Co., Jos., Jersey City, N. J.
*Solvay Process Co., New York
Acme White Ld. & Col. Works, Detroit, Mich.
Berry Bros., Detroit, Mich.
Cook Paint & Varnish Co., Kansas City, Mo.
Detroit Graphite Co., Detroit, Mich.
Detroit White Lead Wks., Detroit, Mich.
Du Pont de Nemours & Co., Inc., E. I., Wilmington, Del.
Minwax Co., New York.
Protexol Corpn., New York.
Ruberoid Co., New York.
Sherwin-Williams Co., Cleveland, O.
Sonneborn Sons, Inc., L., New York.
Toch Bros., New York.
Tropical Paint & Oil Co., Cleveland, Ohio.
Truscon Laboratories, Detroit, Mich.

PAPERS, BLUE PRINT AND BROWN PRINT

Indianapolis Blue Print & Supply Co., Indianapolis, Ind.

PAPER, BUILDING, ROOFING, ETC.

*Barber Asphalt Co., Philadelphia, Pa.
*Barrett Co., New York.
*Carey Co., Philip, Cincinnati, Ohio.
Bird & Son, inc., E. Walpole, Mass.
Brown Co., Portland, Me.
Hydrex Asphalt Products Corp., New York.
Johns-Manville, Inc., New York.
National Roofing Co., Tonawanda, N. Y.
Ruberoid Co., New York.

PARK BENCHES

*Stewart Iron Works Co., Cincinnati, O.
Art Concrete Works, Pasadena, Calif.
Bausman Mfg. Co., Millersville, Pa.
Dow Co., Louisville, Ky.
Meyers Mfg. Co., Fred J., Hamilton, Ohio.
Mott Iron Wks., J. L., New York.

PAVING AND ROAD ROLLERS. (See Road and Paving Rollers)

PAVING BLOCKS, CREOSOTED WOOD

America Creosote Wks., Inc., New Orleans, La.
Carter Bloxonend Flooring Co., Kansas City, Mo.
Creosoted Materials Co., New Orleans, La.
Republic Creosoting Co., Indianapolis, Ind.
Wyckoff Pipe & Creosoting Co., New York.

PAVING BRICK

Albion Shale Brick Co., Albion, Ill.
Alton Brick Co., Alton, Ill.
Barr Clay Co., Streator, Ill.
Bighamton Brick Co., Binghamton, N. Y.
Burton Townsend Co., Zanesville, N. Y.
Cleveland Brick & Clay Co., Cleveland, O.
Clydesdale Brick & Stone Co., Pittsburgh, Pa.
Coffeyville Vit. Brick & Tile Co., Coffeyville, Kans.
Corry Brick & Tile Corp., Corry, Pa.
Flint Brick Co., Des Moines, Ia.
Francis Vit. Brick Co., Boynton, Okla.
Georgia Brick & Tile Co., Adairsville, Ga.
Hammond Fire Brick Co., Fairmont, W. Va.
Hocking Valley Brick Co., Columbus, O.
Hydraulic Press Brick Co., St. Louis, Mo.
Independence Pav. Br. Co., Independence, Kans.
McAvoy Vit. Brick Co., Philadelphia, Pa.
Mack Mfg. Co., Wheeling, W. Va.
Mayer Brick Co., C. P., Bridgeville, Pa.
Medal Paving Brick Co., Cleveland, O.
Metropolitan Paving Brick Co., Canton, O.
Mineral Wells Pav. Brick Co., Mineral Wells, Tx.
Moberly Paving Brick Co., Moberly, Mo.
Murphysboro Paving Brick Co., Murphysboro, Ill.
Patton Clay Mfg. Co., Patton, Pa.
Peebles Brick Co., Portsmouth, O.
Penna. Clay Co., Pittsburgh, Pa.
Pittsburgh Paving Brick Co., Pittsburgh, Kans.
Poston Paving Brick Co., Crawfordsville, Ind.
Purington Paving Brick Co., Galesburg, Ill.
Southern Clay Mfg. Co., Chattanooga, Tenn.
Springfield Paving Brick Co., Springfield, Ill.
Sterling Brick Co., Olean, N. Y.
Streator Clay Mfg. Co., Streator, Ill.
Thornton Fire Brick Co., Clarksburg, W. Va.
Thurber Brick Co., Thurber, Texas.
Toronto Fire Clay Co., Toronto, Ohio.
Trinidad Brick & Tile Co., Trinidad, Ohio.
Veedersburg Pa er Co., Veedersburg, Ind.
Western Clay Mfg. Co., Helena, Mont.
Westport Paving Brick Co., Westport, Md.

PAVING MACHINERY. (See Road and Paving Machinery)

PAVING GUARDS, STEEL

Godwin Co., W. S., Baltimore, Md.

PAVING MATERIALS. (See "Asphalt," "Paving Brick," "Granite Block," etc.)

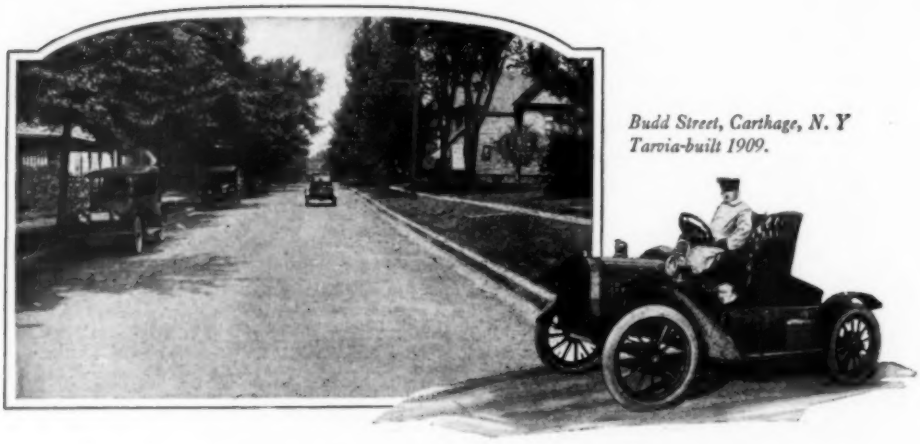
PAVING MIXERS. (See Concrete Mixers)

PAVING TOOLS

*Barber Asphalt Co., Philadelphia, Pa.
*Connery & Co., Inc., Philadelphia, Pa.
*Littleford Bros. Co., Cincinnati, O.
*Warren Bros. Co., Boston, Mass.
Aeroil Burner Co., Union Hill, N. J.
Anderson Tool & Sup. Co., W. H., Detroit, Mich
Cummer & Sons Co., F. D., Cleveland, O.
Union Iron Works, Hoboken, N. J.

PERFORATED METALS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Hendrick Mfg. Co., Carbondale, Pa.



Budd Street, Carthage, N. Y
Tarvia-built 1909.

First welcomed by motorists in 1909 — this Tarvia Street is still good

YOU pioneer motorists—what a thrill of freedom your first car gave you! At last you could travel anywhere—any time.

But comfort was another thing. Generally the roads were dusty or muddy, scarred with ruts and washouts. What relief when you rolled onto Tarvia pavement—smooth, mudless, dustless—like Budd Street in Carthage, New York. Laid in 1909, this Tarvia pavement—after fifteen years of unceasing traffic—is as good as the day it was built.

Tarvia pavement can be kept good indefinitely at little cost. And in addition: A Tarvia pavement will not wave, roll or rut. A Tarvia pavement is skid-proof, because of its granular surface. For the money spent, Tarvia gives more miles and the most years of satisfactory service.

On request, we will gladly send you illustrated booklets, construction data and specifications.

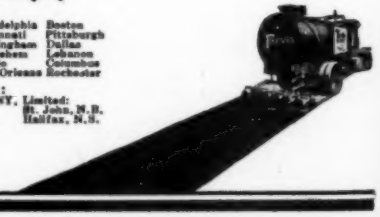
Tarvia
For Road Construction Repair and Maintenance

The Barrett Company

New York	Chicago	Philadelphia	Boston
St. Louis	Cleveland	Cincinnati	Pittsburgh
Detroit	Kansas City	Birmingham	Dallas
Minneapolis	Salt Lake City	Bethlehem	Lebanon
Youngstown	Milwaukee	Toledo	Columbus
Baltimore	Syracuse	New Orleans	Rochester

In Canada:
THE BARRETT COMPANY, Limited:

Montreal	Toronto	St. John, N.B.
Winnipeg	Vancouver	Halifax, N.S.



PICKS

Beall Tool Co., East Alton, Ill.
Hubbard Co., Pittsburgh, Pa.
Iron City Tool Works, Pittsburgh, Pa.
Klein-Logan Co., Pittsburgh, Pa.
Verona Tool Works, Verona, Pa.
Warren Tool & Forge Co., Warren, O.
Warwood Tool Co., Wheeling, W. Va.
Wyoming Shovel Wks., Wyoming, Pa.

PILE DRIVERS

*McKiernan-Terry Drill Co., New York.
Browning Co., Cleveland, O.
Clyde Iron Works Sales Co., Duluth, Minn.
Industrial Works, Bay City, Mich.
Lidgerwood Manufacturing Co., New York.
Mead-Morrison Mfg. Co., E. Boston, Mass.
McMyler Interstate Co., Cleveland, O.
Union Iron Works, Hoboken, N. J.

PILE HAMMERS, STEAM

*McKiernan-Terry Drill Co., New York.
Clyde Iron Works Sales Co., Duluth, Minn.
Industrial Works, Bay City, Mich.
National Hoisting Eng. Co., Harrison, N. J.
Union Iron Works, Hoboken, N. J.
Vulcan Iron Works, Chicago, Ill.

PILING, CONCRETE

MacArthur Concrete Pile & Foundation Co., N. Y.
Raymond Concrete Pile Co., New York.

PILING, INTERLOCKING STEEL

Bethlehem Steel Co., Bethlehem, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Jones & Laughlin Steel Co., Pittsburgh, Pa.

PIPE, CAST IRON

*Central Foundry Co., New York.
*National Cast Iron Pipe Co., Birmingham, Ala.
*U. S. Cast Iron Pipe & Fdy. Co., Burlington, N. J.
American Cast Iron Pipe Co., Birmingham, Ala.
Clow & Sons, J. B., Chicago, Ill.
Donaldson Iron Co., Emans, Pa.
Fox & Co., John, New York.
Glamorgan Pipe & Fdry. Co., Lynchburg, Va.
Lynchburg Foundry Co., Lynchburg, Va.
Warren Fdry. & Machine Co., New York.
Wood & Co., R. D., Philadelphia, Pa.

PIPE, CULVERT. (See Culverts)

PIPE, LEAD

United Lead Company, New York.

PIPE, REINFORCED CONCRETE

Concrete Products Co., Pittsburgh, Pa.
Core Joint Concrete Pipe Co., Baltimore, Md.
Independent Concrete Pipe Co., Indianapolis, Ind.
Lock Joint Pipe Co., E. Orange, N. J.
Massey Concrete Products Corp'n, Chicago, Ill.
Newark Concrete Pipe Co., Newark, N. J.

PIPE, RIVETED STEEL

*Blaw-Knox Co., Pittsburgh, Pa.
*Conery & Co., Inc., Philadelphia, Pa.
*Littleford Bros., Cincinnati, Ohio.
Abendroth & Root Mfg. Co., Newburgh, N. Y.
American Spiral Pipe Works, Chicago, Ill.
Canton Culvert & Silo Co., Canton, O.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
East Jersey Pipe Co., New York.
Hammond Iron Works, Warren, Pa.
Hardesty Mfg. Co., R., Denver, Colo.
Honhorst Co., Jos., Cincinnati, Ohio.
Lancaster Iron Works, Lancaster, Pa.
Petroleum Iron Works Co., Sharon, Pa.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Tippet & Wood, Phillipsburg, N. J.
Welter Mfg. Co., Chicago, Ill.

PIPE, SPIRAL RIVETED

Abendroth & Root Mfg. Co., Newburgh, N. Y.
American Spiral Pipe Works, Chicago, Ill.

PIPE, STEEL

Central Tube Co., Pittsburgh, Pa.
East Jersey Pipe Co., New York.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
National Tube Co., Pittsburgh, Pa.
Republic Iron & Steel Co., Youngstown, O.
Spang-Chalfont & Co., Pittsburgh, Pa.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., Youngstown, O.

PIPE, WOOD

American Wood Pipe Co., Tacoma, Wash.
Continental Pipe Mfg. Co., Seattle, Wash.
Michigan Pipe Co., Bay City, Mich.
Pacific Tank & Pipe Co., San Francisco, Cal.
Redwood Mfrs. Co., San Francisco, Cal.
Standard Wood Pipe Co., Williamsport, Pa.
Wyckoff & Sons Co., A., Elmira, N. Y.

PIPE, WROUGHT IRON

Byers Co., A. M., Pittsburgh, Pa.
Reading Iron Co., Reading, Pa.

PIPE BENDING MACHINES

Amer. Pipe Bending Mach. Co., Boston, Mass.
Walworth Mfg. Co., Boston, Mass.

PIPE COVERING

AIRCELL

*Carey Co., Philip, Cincinnati, Ohio.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Johns-Manville, Inc., New York.
Keasbey & Mattison Co., Ambler, Pa.
Nat'l Asbestos Co., Jersey City, N. J.
Norristown Mag. & Asb. Co., Norristown, Pa.
Sall Mt. Co., Chicago, Ill.
Watson Co., H. F., Erie, Pa.

85 PER CENT MAGNESIA

*Carey Co., Philip, Cincinnati, Ohio.
Ehret Magnesia Co., Valley Forge, Pa.
Johns-Manville, Inc., New York.
Keasbey & Mattison Co., Ambler, Pa.

WOOD

Continental Pipe Mfg. Co., Seattle, Wash.
Redwood Mfrs. Co., San Francisco, Cal.
Ric-Wil Co., Cleveland, O.
Wyckoff & Son Co., A., Elmira, N. Y.

PIPE CUTTERS. (See Cutters, Pipe, Hand.)

PIPE FITTINGS

*Central Foundry Co., New York.
*Nat'l Cast Iron Pipe Co., Birmingham, Ala.
*U. S. Cast Iron Pipe & Fdry. Co., Burlington, N. J.
American C. I. Pipe Co., Birmingham, Ala.
Builders Iron Fdry., Providence, R. I.
Clow & Sons, J. B., Chicago, Ill.
Crane Co., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
Reading Steel Casting Co., Inc., Bridgeport, Conn
Warren Fdry. & Mach. Co., New York.
Wood & Co., R. D., Philadelphia, Pa.

PIPE HANDLING MACHINERY

Mueller Company, Decatur, Ill.
Taylor Portable Steel Derrick Co., Chicago, Ill.

PIPE JOINT COMPOUND. (Sewer)

*Carey Co., Philip, Cincinnati, Ohio.
*Waring-Underwood Co., Philadelphia, Pa.
G. K. Sales Co., Macungie, Pa.
Leadite Company, Inc., Philadelphia, Pa.
Pacific Flush Tank Co., Chicago, Ill.
Ruberoid Co., New York.

PIPE JOINT MATERIAL. (Cast Iron)

Lead-Hydro-Tite Co., Boston, Mass.
Leadite Co., The, Philadelphia, Pa.
United Lead Co., New York.

PLAYGROUND APPARATUS

American Playground Device Co., Anderson, Ind.
Everwear Mfg. Co., Springfield, O.
Exerswing Co., Minneapolis, Minn.
George, Howard, Philadelphia, Pa.
Hill-Standard Co., Anderson, Ind.
Medart Mfg. Co., Fred., St. Louis, Mo.
Patterson, Williams Co., San Jose, Calif.
Spalding & Bros., A. G., Chicopee, Mass.

PLOWS, CONTRACTORS

*Austin-Western Rd. Mach. Co., Chicago, Ill.
*Burch Plow Works Co., Crestline, O.
*Holt Mfg. Co., Peoria, Ill.
*Russell Grader Mfg. Co., Minneapolis, Minn.
Adams & Co., J. D., Indianapolis, Ind.

Another big job for

McKIERNAN-TERRY HAMMERS

Five 9-B's driving 18,000 piles for the foundation of the New York Edison Power Plant

The work for this $30,000,000 plant, at 14th Street and East River, New York City, is being handled by the P. T. Cox Contracting Company. It involves, at present, 18,000 wood piles, spaced 2-ft. 6-in. centers, driven as a mat covering two city blocks. Piles average 30 ft. penetration, the majority with points 8 in. to 11 in. diameter, with butts up to 16 in. The driving is very hard, into a dense, heavy mixture of coarse sand and clay.

"We have been easily maintaining 50 piles per 8-hour day per hammer," writes the P. T. Cox Contracting Company. "We have found McKiernan Terry 9-B Hammers very satisfactory in every respect."

The equipment on the job consists of five 9-B Hammers, operated in two travelers with swinging leads, each operating two hammers; and one land rig. Note perfect condition of pile butts in photograph.

Bulletin 31 describes all McKiernan-Terry Hammers.

McKiernan-Terry Drill Company

Rock Drills Pile Hammers Lifting Jacks
Mining and Quarrying Machinery

19 Park Row, New York

Works at Dover, N. J.

Agencies in the following cities: Boston, Chicago, Pittsburgh, Cleveland, Detroit, St. Paul, San Francisco, Columbus, O., New Orleans, Philadelphia, Portland, Oregon.

Foreign Representatives: British Steel Piling Co., London, England.

American Steel Scraper Co., Sidney, O.
Deere & Co., Moline, Ill.
International Harvester Co., Chicago, Ill.
Moline Plow Co., Rock Island, Ill.
Oliver Chilled Plow Works, South Bend, Ind.
Sidney Steel Scraper Co., Sidney, O.
Slusser-McLean Scraper Co., Sidney, O.
Smith & Sons Mfg. Co., Kansas City, Mo.
Western Wheeled Scraper Co., Aurora, Ill.
Wiard Plow Co., Batavia, N. Y.

PLUMBING SUPPLIES

Clow & Sons, J. B., Chicago, Ill.
Crane Co., Chicago, Ill.
Glauber Brass Mfg. Co., Cleveland, O.
Mott Iron Wks., J. L., New York.
Mueller Company, Decatur, Ill.
Rundle-Spence Mfg. Co., Milwaukee, Wis.
United Brass Mfg. Co., Cleveland, O.
Walworth Mfg. Co., Boston, Mass.

POLES, STEEL STRUCTURAL

*Blaw-Knox Co., Pittsburgh, Pa.
Electric Railway Equipment Co., Cincinnati, O.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.

PORTABLE BUILDINGS

*Blaw-Knox Co., Pittsburgh, Pa.
*Littleford Bros., Cincinnati, Ohio.
*Truscon Steel Co., Youngstown, O.
Kolb Building Co., New York.
Milwaukee Corrugating Co., Milwaukee, Wis.

PORTABLE STEEL DERRICKS. (See Derricks, Steel Portable.)

PORTLAND CEMENT. (See Cement.)

POWDER. (See Explosives.)

POWER PLANTS, INDUSTRIAL

*Climax Engineering Co., Clinton, Iowa

PUMPS, AIR LIFT

*American Steam Pump Co., Battle Creek, Mich.
Harris Air Pump Co., Indianapolis, Ind.
Indiana Air Pump Co., Indianapolis, Ind.
Ingersoll-Rand Co., New York.
Sullivan Machinery Co., Chicago, Ill.

PUMPS, BOILER FEED

*American Steam Pump Co., Battle Creek, Mich.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Aurora Pump & Mfg. Co., Aurora, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Steam Pump Co., Buffalo, N. Y.
Cameron Steam Pump Works, A. S., New York
Dayton-Dowd Co., Quincy, Ill.
Dean Bros. Co., Indianapolis, Ind.
De Laval Steam Turbine Co., Trenton, N. J.
Deming Co., Salem, O.
Fairbanks, Morse & Co., Chicago, Ill.
Gardner Governor Co., Quincy, Ill.
Goulds Mfg. Co., Seneca Falls, N. Y.
Indiana Air Pump Co., Indianapolis, Ind.
LeCourtenay Co., Newark, N. J.
Morris Machine Works, Baldwinsville, N. Y.
Murray Iron Works Co., Burlington, Ia.
Northern Fire Apparatus Co., Minneapolis, Minn.
Rumsey Pump Co., Seneca Falls, N. Y.
Scranton Pump Co., Scranton, Pa.
Union Steam Pump Co., Battle Creek, Mich.
Vogt Bros. Mfg. Co., Louisville, Ky.
Warren Steam Pump Co., Warren, Mass.
Weinman Pump Mfg. Co., Columbus, O.
Yeomans Bros. Co., Chicago, Ill.

PUMPS, CENTRIFUGAL

*American Steam Pump Co., Battle Creek, Mich.
*Domestic Engine & Pump Co., Shippensburg, Pa.
*Keystone Driller Co., Beaver Falls, Pa.
*Novo Engine Co., Lansing, Mich.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Well Works, Aurora, Ill.
Aurora Pump & Mfg. Co., Aurora, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Cameron Steam Pump Works, A. S., New York.
Dayton-Dowd Co., Quincy, Ill.
De Laval Steam Turbine Co., Trenton, N. J.
Erie Pump & Engine Works, Medina, N. Y.
Fairbanks, Morse & Co., Chicago, Ill.
Goulds Mfg. Co., Seneca Falls, N. Y.
Indiana Air Pump Co., Indianapolis, Ind.
LeCourtenay Co., Newark, N. J.
Manistee Iron Wks., Manistee, Mich.
Morris Machine Works, Baldwinsville, N. Y.
Rumsey Pump Co., Seneca Falls, N. Y.
Schramm, Inc., West Chester, Pa.
Tokheim Oil Tank & Pump Co., Ft. Wayne, Ind.
United Iron Works, Inc., Kansas City, Mo.
Wheeler Condenser & Eng. Co., Carteret, N. J.
Worthington Pump & Mchy. Corp., New York.
Yeomans Bros. Co., Chicago, Ill.

PUMPS, CONTRACTORS'

*American Steam Pump Co., Battle Creek, Mich.
*Construction Mach'y Co., Waterloo, Ia.
*Domestic Engine & Pump Co., Shippensburg, Pa.
*Kinney Mfg. Co., Boston, Mass.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Well Works, Aurora, Ill.
Aurora Pump & Mfg. Co., Aurora, Ill.
Barnes Mfg. Co., Mansfield, O.
Buda Co., Harvey, Ill.
Cameron Steam Pump Works, A. S., New York.
Carter Co., Ralph B., New York.
C. H. & E. Manufacturing Co., Milwaukee, Wis.
Dayton-Dowd Co., Quincy, Ill.
Deming Co., Salem, Ohio.
Emerson Pump & Valve Co., Alexandria, Va.
Erie Pump & Engine Works, Medina, N. Y.
Fairbanks, Morse & Co., Chicago, Ill.
Goulds Mfg. Co., Seneca Falls, N. Y.
LeCourtenay Co., Newark, N. J.
McGowan Co., J. H., Cincinnati, O.
Morris Machine Works, Baldwinsville, N. Y.
Myers & Bro. Co., F. E., Ashland, O.
Northern Fire App. Co., Minneapolis, Minn.
Novo Engine Co., Lansing, Mich.
Pulsometer Steam Pump Co., New York.
Rumsey Pump Co., Seneca Falls, N. Y.
Schramm, Inc., West Chester, Pa.
Smith Co., T. L., Milwaukee, Wis.
Standard Scale & Supply Co., Pittsburgh, Pa.
Van Nouhuys Machine Wks., Albany, N. Y.
Waldo Bros. & Bond Co., Boston, Mass.

PUMPS, DEEP WELL

*Aldrich Pump Co., Allentown, Pa.
*American Steam Pump Co., Battle Creek, Mich.
*Domestic Engine & Pump Co., Shippensburg, Pa.
*Keystone Driller Co., Beaver Falls, Pa.
American Well Works, Aurora, Ill.
Cameron Steam Pump Works, A. S., New York.
Clark Co., H. W., Mattoon, Ill.
Cook, Inc., A. D., Lawrenceburg, Ind.
Deming Co., Salem, O.
Fairbanks, Morse & Co., Chicago, Ill.
Goulds Mfg. Co., Seneca Falls, N. Y.
Harris Air Pump Co., Indianapolis, Ind.
Indiana Air Pump Co., Indianapolis, Ind.
Layne & Bowler Co., Memphis, Tenn.
McDonald Mfg. Co., A. Y., Dubuque, Ia.
Midwest Engine Co., Indianapolis, Ind.
Myers & Bro. Co., F. E., Ashland, O.
Rumsey Pump Co., Seneca Falls, N. Y.
United Iron Works, Inc., Kansas City, Mo.
Weber Subterranean Pump Co., New York.

PUMPS, DREDGING

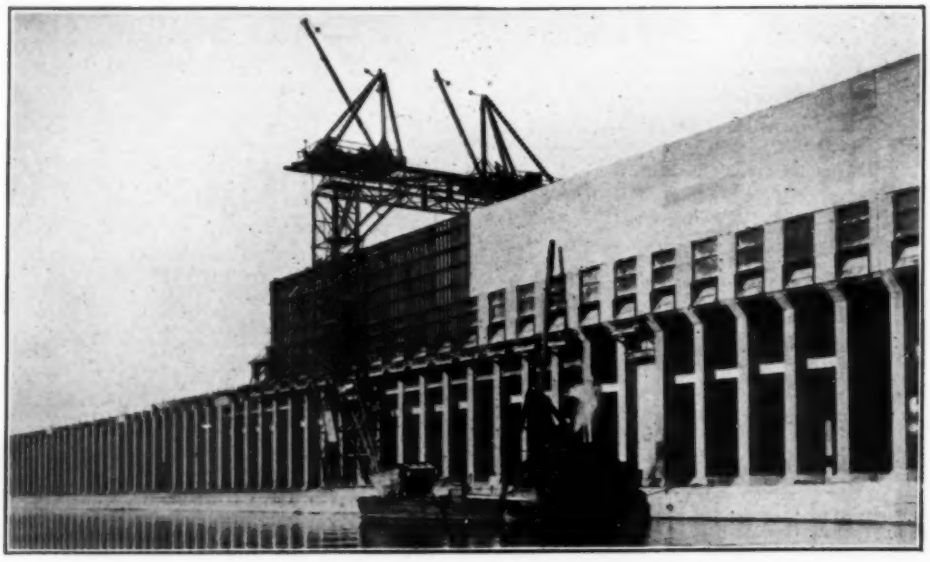
*Aldrich Pump Co., Allentown, Pa.
*American Steam Pump Co., Battle Creek, Mich.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Well Works, Aurora, Ill.
Ellicott Machine Corp., Baltimore, Md.
Erie Pump & Engine Co., Medina, N. Y.
Morris Machine Works, Baldwinsville, N. Y.
Worthington Pump & Mchy. Corp., New York.

PUMPS, GASOLINE AND OIL

*Kinney Mfg. Co., Boston, Mass.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Wayne Tank & Pump Co., Fort Wayne, Ind.

PUMPS, POWER

*American Steam Pump Co., Battle Creek, Mich.
*Kinney Mfg. Co., Boston, Mass.
*Koehring Co., Milwaukee, Wis.
*Novo Engine Co., Lansing, Mich.
Alamo Iron Works, San Antonio, Tex.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Well Works, Aurora, Ill.
Aurora Pump & Mfg. Co., Aurora, Ill.
Barnes Mfg. Co., Mansfield, O.
Dayton-Dowd Co., Quincy, Ill.
De Laval Steam Turbine Co., Trenton, N. J.
Deming Co., Salem, O.
Domestic Engine & Pump Co., Shippensburg, Pa.
Evinrude Motor Co., Milwaukee, Wis.



Wading Through a Big Job

Foley Brothers use a Blaw-Knox Batcher plant—mounted on a barge.

Products

Steel Forms
Road Building Equipment
Inundation Method
Clamshell Buckets
Standard Buildings
Transmission Towers
Structural Steel
Forge and Hammer Welding
Reversing Valves

Foley Bros., Peppard & Fulton Contractors, were entrusted with the building of the 1100 foot extension to the "Soo Line's" immense ore dock at Ashland, Wisconsin. The aid of Blaw-Knox was enlisted in designing and building steel forms for the work.

BLAWFORMS were furnished—and a 100 ft. high traveler was built to handle these forms for building the intricate ore pockets.

The result is that Foley Brothers are wading right through this big job with a big saving in time, labor and trouble. Pockets are being poured and forms are being moved with clock-like regularity.

This is one of the thousands of concrete jobs, large and small, successfully built with BLAWFORMS. On your next job, confer with the men who have been responsible for these successful forming operations.

Engineering advice costs you nothing! Much can be gained.

WHAT HAVE YOU TO BUILD?

BLAW-KNOX COMPANY

607 Farmer's Bank Bldg. Pittsburgh, Pa.

NEW YORK—30 E. 42nd St. CHICAGO—Peoples Gas Bldg.
BALTIMORE—Bayard & Warner Sts. DETROIT—Lincoln Bldg.
BIRMINGHAM—Brown-Marx Bldg. BUFFALO—Genesee Bldg.
LONDON, ENG.—Caxton Bldg.

BLAW-KNOX **Blawforms**

Fairbanks, Morse & Co., Chicago, Ill.
Gardner Governor Co., Quincy, Ill.
Goulds Mfg. Co., Seneca Falls, N. Y.
Indiana Air Pump Co., Indianapolis, Ind.
Lawrence Machine Co., Lawrence, Mass.
Le-Courtenay Co., Newark, N. J.
McGown Co., J. H., Cincinnati, O.
Myers & Bro. Co., F. E., Ashland, O.
Nordberg Mfg. Co., Milwaukee, Wis.
Northern Fire Apparatus Co., Minneapolis, Minn.
Rumsey Pump Co., Seneca Falls, N. Y.
Weinman Pump Mfg. Co., Columbus, O.
Worthington Pump & Machy. Corp., New York.
Yoemans Bros. Co., Chicago, Ill.

PUMPS, TAR AND ASPHALT

*Kinney Mfg. Co., Boston, Mass.

RAILS AND RAIL JOINTS

*Koppel Ind. Car & Equip. Co., Koppel, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Easton Car & Const'n Co., Easton, Pa.
Sweet's Steel Co., Williamsport, Pa.

RAILROAD DITCHERS (See Excavators, Ditch and Trench.)

RECORDERS, WATER STAGE

Builders Iron Fdry., Providence, R. I.
Gurley, W. & L. E., Troy, N. Y.

REFRIGERATING MACHINERY. (See Ice Making Machinery.)

REINFORCING CONCRETE. (See Concrete Reinforcements.)

RIVETERS, PNEUMATIC

Alliance Machine Co., Alliance, O.
Chicago Pneumatic Tool Co., New York.
Cleveland Pneumatic Tool Co., Cleveland, O.
Hanna Eng. Works, Chicago, Ill.
Helwig Mfg. Co., St. Paul, Minn.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., New York.
Watson-Stillman Co., New York.

RIVET SETS

Cleveland Pneumatic Tool Co., Cleveland, O.
Dunbar Drop Forge Co., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., New York.

RIVETS, BRIDGE AND STRUCTURAL. (See Bolts, Nuts, Etc.)

ROAD GRADERS

*Austin-Western Road Mchy. Co., Chicago, Ill.
*Baker Mfg. Co., Springfield, Ill.
*Good Roads Mach'y Co., Kennett Square, Pa.
*Russell Grader Mfg. Co., Minneapolis, Minn.
*Stockland Road Mach. Co., Minneapolis, Minn.
Adams & Co., J. D., Indianapolis, Ind.
Case Threshing Machine Co., J. I., Racine, Wis.
Galion Iron Works & Mfg. Co., Galion, Ohio
Gilbert Mfg. Co., Aberdeen, S. D.
Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
Monroe & Sons, N. S., Arthur, Ill.
Shaw-Enochs Tractor Co., Minneapolis, Minn.
Smith & Sons Mfg. Co., Kansas City, Mo.
Western Wheeled Scraper Co., Aurora, Ill.

ROAD OILS. (See Oils, Road.)

ROAD OILERS

*Austin-Western Road Mchy. Co., Chicago, Ill.
*Connery & Co., Philadelphia, Pa.
*Good Roads Mach'y Co., Kennett Square, Pa.
*International Motor Co., New York.
*Kinney Mfg. Co., Boston, Mass.
*Littleford Bros., Cincinnati, O.
*Spears-Wells Mach'y Co., Oakland, Cal.
Etnyre & Co., E. D., Oregon, Ill.
White Co., Cleveland, O.

ROAD SCRAPERS

*Acme Road Mach. Co., Frankfort, N. Y.
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Baker Mfg. Co., Springfield, Ill.
*East Iron & Machine Co., Lima, Ohio.
*Good Roads Mach'y Co., Kennett Square, Pa.
*Russell Grader Mfg. Co., Minneapolis, Minn.
*Stockland Road Machy. Co., Minneapolis, Minn.
Adams & Co., J. D., Indianapolis, Ind.
Case Threshing Machine Co., J. I., Racine, Wis.
Galion Iron Works & Mfg. Co., Galion, Ohio
Gilbert Mfg. Co., Aberdeen, S. D.
Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
Miami Trailer-Scraper Co., Troy, Ohio.
Root Spring Scraper Co., Kalamazoo, Mich.
Sidney Steel Scraper Co., Sidney, O.
Smith & Sons Mfg. Co., Kansas City, Mo.
Western Wheeled Scraper Co., Aurora, Ill.

ROAD AND PAVING ROLLERS

*Austin-Western Road Mchy. Co., Chicago, Ill.
*Barber Asphalt Co., Philadelphia, Pa.
*Buffalo Springfield Roller Co., Springfield, O.
*Good Roads Mach. Co., Kennett Square, Pa.
*Huber Mfg. Co., Marion, O.
Case Threshing Machine Co., J. I., Racine, Wis.
Erie Machine Shops, Erie, Pa.
Galion Iron Works & Mfg. Co., Galion, Ohio

ROAD AND PAVING MACHINERY

*Atlas Engineering Co., Milwaukee, Wis.
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Baker Mfg. Co., Springfield, Ill.
*Barber Asphalt Co., Philadelphia, Pa.
*Blaw-Knox Co., Pittsburgh, Pa.
*Buffalo Springfield Roller Co., Springfield, O.
*Connery & Co., Inc., Philadelphia, Pa.
*East Iron & Mach. Co., Lima, Ohio.
*Equitable Asph. Maint. Co., Kansas City, Mo.
*Good Roads Mach. Co., Kennett Square, Pa.
*Haiss Mfg. Co., Geo., New York.
*Holt Mfg. Co., Peoria, Ill.
*International Motor Co., New York.
*Kinney Mfg. Co., Boston, Mass.
*Koehring Co., Milwaukee, Wis.
*Littleford Bros., Cincinnati, O.
*Ransome Concrete Mchy. Co., Dunellen, N. J.
*Russell Grader Mfg. Co., Minneapolis, Minn.
*Spears-Wells Machy. Co., Oakland, Cal.
*Stockland Road Mach. Co., Minneapolis, Minn.
*Universal Road Mchy. Co., Kingston, N. Y.
Acme Road Mach. Co., Frankfort, N. Y.
Adams & Co., J. D., Indianapolis, Ind.
Austin Machinery Corp'n, Muskegon, Mich.
Bucyrus Road Machy. Co., Bucyrus, O.
Case Threshing Machine Co., J. I., Racine, Wis.
Cummer & Son Co., F. D., Cleveland, O.
Easton Car & Const'n Co., Easton, Pa.
Edwards Mfg. Co., C. D., Albert Lea, Minn.
Erie Machine Shops, Erie, Pa.
Farassey Co., J. D., Cleveland, Ohio
Galion Iron Works & Mfg. Co., Galion, Ohio
Gilbert Mfg. Co., Aberdeen, S. Dak.
Glide Road Mach'y Co., Minneapolis, Minn.
Honhorst Co., Jos., Cincinnati, O.
Lakewood Engineering Co., Cleveland, O.
Lyle Culv. & Rr. Equip. Co., Minneapolis, Minn.
Monroe & Sons, N. S., Arthur, Ill.
Northfield Iron Co., Northfield, Minn.
Smith Co., T. L., Milwaukee, Wis.
Smith & Sons Mfg. Co., Kansas City, Mo.
United Iron Works, Inc., Kansas City, Mo.

ROCK CRUSHERS AND PULVERIZERS (See "Crushers")

ROCK DRILLS. (See Drills, Rock.)

ROOFING, ASPHALT, COMPOSITION, TILE, ETC.

*Barber Asphalt Co., Philadelphia, Pa.
*Barrett Co., New York.
*Carey Co., Philip, Cincinnati, Ohio.
*Standard Oil Co. (Indiana), Chicago, Ill.
*Texas Co., New York.
American Cement Tile Mfg. Co., Pittsburgh, Pa.
Atlantic Refining & Asphalt Corp., Phila., Pa.
Beaver Products Co., Inc., Buffalo, N. Y.
Bird & Son, Inc., E. Walpole, Mass.
Certain-teed Products Corp., New York.
Chatfield Mfg. Co., Cincinnati, Ohio.
Edwards Mfg. Co., Cincinnati, O.
Flintkote Co., Boston, Mass.
Johns-Manville, Inc., New York.
Keystone Roofing Mfg. Co., York, Pa.
Lehon Co., The, Chicago, Ill.
Lewis Mfg. Co., F. J. Chicago, Ill.
National Roofing Co., Tonawanda, N. Y.
Ruberoid Co., New York.
Sall Mountain Co., Chicago, Ill.
Sifo Products Co., St. Paul, Minn.
Sonneborn & Sons, Inc., L., New York.
United States Gypsum Co., Chicago, Ill.
Western Elaterite Roofing Co., Denver, Colo.

ROOFING, METAL

*Truscon Steel Co., Youngstown, O.

Concrete Curing Problems Solved

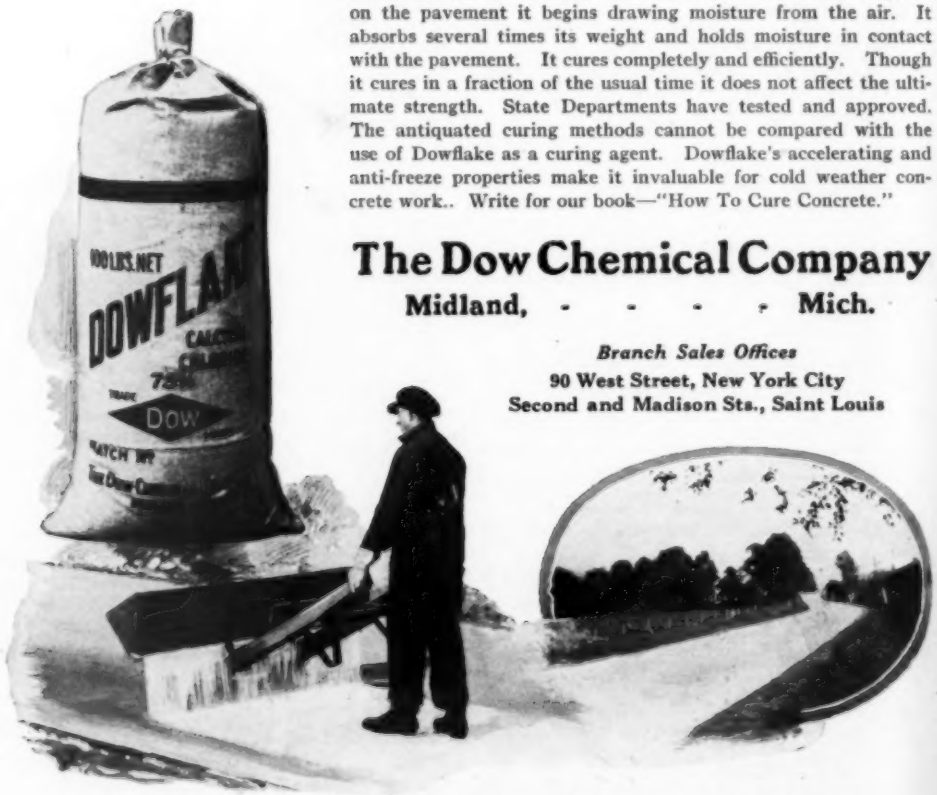
The actual making of concrete begins when water is added to the dry ingredients in the mix. The physical and chemical action starts immediately and must continue long after the concrete is poured to secure tough, enduring pavements.

The curing process is a means to maintain the required supply of moisture until the action within the cement is finished. Moisture enables the stone making process to work itself to completion.

The first methods of getting and holding moisture were awkward. They involved the work of men with pipelines, pumps and hose. Grading, scraping, banking and earth removal were costly and time consuming.

The modern method removes all these obstacles. It does the same thing as the old-fashioned, awkward, costly methods.

One man can quickly apply Dowflake to the full day's mixer run. Dowflake is a clean, odorless chemical Salt. As soon as spread on the pavement it begins drawing moisture from the air. It absorbs several times its weight and holds moisture in contact with the pavement. It cures completely and efficiently. Though it cures in a fraction of the usual time it does not affect the ultimate strength. State Departments have tested and approved. The antiquated curing methods cannot be compared with the use of Dowflake as a curing agent. Dowflake's accelerating and anti-freeze properties make it invaluable for cold weather concrete work.. Write for our book—"How To Cure Concrete."



The Dow Chemical Company

Midland, - - - - Mich.

Branch Sales Offices

90 West Street, New York City
Second and Madison Sts., Saint Louis

American Rolling Mill Co., Middletown, Ohio.
Amer. Sheet & Tin Plate Co., Pittsburgh, Pa.
Berger Mfg. Co., Canton, O.
Edwards Mfg. Co., Cincinnati, O.
Klauer Mfg. Co., Dubuque, Ia.
Milwaukee Corrugating Co., Milwaukee, Wis.
Nat'l Sheet Metal Roofing Co., Jersey City, N. J.
United Alloy Steel Corpn., Canton, O.
Youngstown Sheet & Tube Co., Youngstown, O.

ROOFING KETTLES. (See Kettles)

ROPE, MANILA
American Mfg. Co., Brooklyn, N. Y.
Columbian Rope Co., Auburn, N. Y.
Cupples Cordage Co., Brooklyn, N. Y.
Hooven & Allison Co., Xenia, O.
Kelly Co., R. A., Xenia, O.
New Bedford Cordage Co., New Bedford, Mass.
Peoria Cordage Co., Peoria, Ill.
Plymouth Cordage Co., N. Plymouth, Mass.
Wall Rope Wks., New York.
Waterbury Co., New York.
Whitlock Cordage Co., New York.

ROPE, WIRE, HOISTING, HAULAGE
*Wickwire Spencer Steel Corp., New York.
*Williamsport Wire Rope Co., Williamsport, Pa.
American Steel & Wire Co., Chicago, Ill.
Broderick & Bascom Rope Co., St. Louis, Mo.
Leschen & Sons Rope Co., A., St. Louis, Mo.
MacWhyte Co., Kenosha, Wis.
Moon Co., Geo. C., Garwood, N. J.
Roebling's Sons Co., J. A., Trenton, N. J.
Upson-Walton Co., Cleveland, O.
Waterbury Co., New York.

RUBBER TIRES. (See Tires.)

RULES
*Lufkin Rule Co., Saginaw, Mich.

SAFETY TREADS. (See Treads, Safety)

SASH, ROLLER STEEL. (See Window Frames and Sash)

SAW RIGS, PORTABLE
*Amer. Saw Mill Mach. Co., Hackettstown, N. J.
C. H. & E. Manufacturing Co., Milwaukee, Wis.
Knickerbocker Co., Jackson, Mich.
Leach Co., Oshkosh, Wis.

SCARIFIERS
*Austin Western Road Mchy. Co., Chicago, Ill.
*Barber Asphalt Co., Philadelphia, Pa.
*Buffalo Springfield Roller Co., Springfield, O.
*Good Roads Mach. Co., Kennett Square, Pa.
*Huber Mfg. Co., Marion, O.
*Kinney Mfg. Co., Boston, Mass.
*Russell Grader Mfg. Co., Minneapolis, Minn.
*Spears-Wells Machy. Co., Oakland, Cal.
*Stockland Road Mach. Co., Minneapolis, Minn.
*Universal Road Machinery Co., Kingston, N. Y.
Acme Road Mach. Co., Frankfort, N. Y.
Adams & Co., J. D., Indianapolis, Ind.
Case Threshing Mach. Co., J. I., Racine, Wis.
Gallion Iron Works & Mfg. Co., Galion, Ohio
Gilbert Mfg. Co., Aberdeen, S. Dak.
Lyle Cul. & Rd. Equip. Co., Minneapolis, Minn.

SCARIFIERS, TEETH FOR
*Shunk Mfg. Co., Bucyrus, Ohio.

SCOOPS
*Oliver Ames & Sons Corp., North Easton, Mass.
*Ames Shovel & Tool Co., Boston, Mass.
*Geo. Griffiths Co., Cheltenham, Pa.
*The H. M. Myers Co., Beaver Falls, Pa.
*T. Rowland's Sons, Inc., Cheltenham, Pa.
*St. Louis Shovel Co. Plant, St. Louis, Mo.
*Wright Shovel Co., Anderson, Ind.

SCRAPERS, DRAGLINE
*Sauerman Bros., Chicago, Ill.

SCRAPERS, POWER DRAG
*L. P. Green, Chicago, Ill.
*Sauerman Bros., Chicago, Ill.

SCRAPERS, ROAD (See Road Scrapers)

SCRAPERS, SELF-LOADING
*Baker Mfg. Co., Springfield, Ill.

SCREENS, SAND, GRAVEL AND COAL
*Atlas Eng. Co., Milwaukee, Wis.
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Good Roads Mach'y Co., Kennett Square, Pa.
*L. P. Green, Chicago, Ill.
*Haiss Mfg. Co., New York.
*Littleford Bros., Cincinnati, O.
*Russell Grader Mfg. Co., Minneapolis, Minn.
*Universal Road Machinery Co., Kingston, N. Y.
*Wickwire Spencer Steel Corp., New York.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Austin Mfg. Co., Chicago, Ill.
C. O. Bartlett & Snow Co., Cleveland, Ohio.
Case Threshing Machine Co., J. I., Racine, Wis.
Chain Belt Co., Milwaukee, Wis.
Gallion Iron Wks. & Mfg. Co., Galion, Ohio.
Gifford-Wood Co., Hudson, N. Y.
Hendrick Mfg. Co., Carbondale, Pa.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Chicago, Ill.
Lyle Culv. & Rd. Equip. Co., Minneapolis, Minn.
Newaygo Eng. Co., Newaygo, Mich.
New Jersey Wire Cloth Co., Trenton, N. J.
Robins Conv. Belt Co., New York.
Sackett Screen & Chute Co., H. B., Chicago, Ill.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

SCREENS, SEWAGE
Green Bay Fdry. & Mach Wks., Green Bay, Wis.
Link-Belt Co., Philadelphia, Pa.
Sanitation Corp'n, New York.
Simplex Ejector Co., Chicago, Ill.

SEWAGE DISPOSAL APPARATUS
Dorr Co., New York.
Pacific Flush Tank Co., Chicago, Ill.
Sanitation Corp'n, New York.
Simplex Ejector Co., Chicago, Ill.

SEWAGE PUMPS (See "Pumps, Centrifugal")

SEWAGE EJECTORS
Pacific Flush Tank Co., Chicago, Ill.
Sanitation Corp'n, New Yorrk.
Simplex Ejector Co., Chicago, Ill.
Yeomans Bros. Co., Chicago, Ill.

SEWER BLOCKS, SEGMENT
American Vit. Products Co., Akron, O.
Cannelton Sewer Pipe Co., Cannelton, Ind.
Denver Sewer Pipe & Clay Co., Denver, Col.
Evens & Howard Fire Brick Co., St. Louis, Mo.
Dickey Clay Mfg. Co., W. S., Kansas City, Mo.
Laclede Christy Clay Products Co., St. Louis, Mo.
Macomb Sewer Pipe Wks., Macomb, Ill.
Pacific Clay Products Co., Los Angeles, Cal.
Red Wing Sewer Pipe Co., Red Wing, Minn.
Robinson Clay Products Co., Akron, O.
Standard Fire Brick & Sewer Pipe Co., Pueblo, Col.

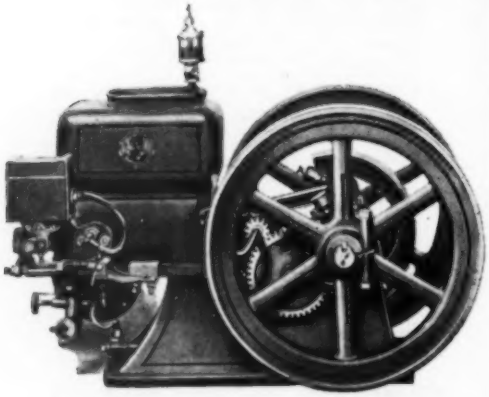
SEWER CLEANING APPARATUS
Champion Corporation, Hammond, Ind.
Self Propelling Nozzle Co., New York.
Turbine Sewer Machine Co., Milwaukee, Wis.

SEWER PIPE AND DRAIN TILE
American Vit. Products Co., Akron, O.
Blackner & Post Pipe Co., St. Louis, Mo.
Dee Co., Wm. E., Chicago, Ill.
Delaware Clay Products Co., Pittsburgh, Pa.
Dickey Clay Mfg. Co., W. S., Kansas City, Mo.
Denver Sewer Pipe & Clay Co., Denver, Col.
National Fireproofing Co., Pittsburgh, Pa.
Ohio Vitrified Pipe Co., Uhrichsville, O.
Robinson Clay Products Co., Akron, O.

SEWER RODS
Bissell Co., F., Toledo, O.
Champion Corporation, Hammond, Ind.
P. J. Healy, New York.
Turbine Sewer Machine Co., Milwaukee, Wis.

SHINGLES, METAL
Berger Mfg. Co., Canton, Ohio.
Canton Art Metal Co., Canton, Ohio.
Edwards Mfg. Co., Cincinnati, Ohio.
Eller Mfg. Co., Canton, Ohio.
Milwaukee Corrugating Co., Milwaukee, Wis.
Nat'l Sheet Metal Roofing Co., Jersey City, N. J.
Newport Rolling Mill Co., Newport, Ky.
Penn Metal Co., Boston, Mass.
Klauer Mfg. Co., Dubuque, Ia.

HERCULES ENGINES



STANDARD EQUIPMENT

on leading makes of Concrete Mixers

For absolute, sure fire reliability under heavy, steady loads—and for easy starting even in the worst of weather—the Hercules is the choice of manufacturers who sell their concrete mixing machines with strong guarantee of permanent satisfaction. They take no chances on less dependable engines—nor should you.

The price of a dependable Hercules is only a fraction of what an engine breakdown might cost you.

Hercules engines have the marvelous Wico Magneto—the nearest to perfection we have ever known. Simple and never failing, it delivers a flaming hot spark that starts the Hercules instantly in zero weather—and keeps it running without a miss. The Hercules puts a full stop to engine troubles.

Jaeger Tilting Driven Mixer "A Mix a minute" with the reliable Hercules Engine.

Smith Non-Tilting Mixer Long service in construction work—in the past and in the future. Hercules durability again.

Orr & Sembower "Cub" A young bear for work with the Hercules engine driving.

Olsen Concrete Mixer Thorough mixing — handled faster by Hercules Engine power.

Atlas Power Loader Mixer. The power is a Hercules Engine.

The Hercules Corporation

Engine Division B

Evansville, Ind. U. S. A.

Tiffin Art Metal Co., Tiffin, Ohio.
Wheeling Metal Mfg. Co., Wheeling, W. Va.

SHORES
The O. D. G. Co., Owensboro, Ky.
Roos-Meyer-Hecht Co., Cincinnati, O.
Symonds Clamp & Mfg. Co., Chicago, Ill.
Universal Form Clamp Co., Chicago, Ill.

SHOVELS, ELECTRIC
*Bay City Dredge Works, Bay City, Mich.
Bucyrus Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
Thew Shovel Co., Lorain, O.

SHOVELS, GASOLINE
*Bay City Dredge Works, Bay City, Mich.
*Pawling & Harnischfeger Co., Milwaukee, Wis.
American Steel Dredge Co., Fort Wayne, Ind.
Austin Machinery Corp'n, Muskegon, Mich.
Fairbanks Steam Shovel Co., Marion, O.
Marion Steam Shovel Co., Marion, O.
Thew Shovel Co., Lorain, O.

SHOVELS, HAND
*Oliver Ames & Sons Corp., North Easton, Mass.
*Ames Shovel & Tool Co., Boston, Mass.
*Geo. Griffiths Co., Cheltenham, Pa.
*The H. M. Myers Co., Beaver Falls, Pa.
*T. Rowland's Sons, Inc., Cheltenham, Pa.
*St. Louis Shovel Co. Plant, St. Louis, Mo.
*Wright Shovel Co., Anderson, Ind.
Beall Bros. Co., Alton, Ill.
Conneaut Shovel Co., Conneaut, O.
Hubbard & Co., Pittsburgh, Pa.
Indiana Shovel Co., New Castle, Ind.
Jackson Shovel Co., Montpelier, Ind.
Pittsburgh Shovel Co., Pittsburgh, Pa.
Russell Shovel Co., Aliquippa, Pa.
Stevens-Webb Co., Inc., Altoona, Pa.
Union Furnace Mfg. Co., Altoona, Pa.
Wood Shovel & Tool Co., Piqua, Ohio.
Wyoming Shovel Works, Wyoming, Pa.

SHOVELS, STEAM
*Keystone Driller Co., Beaver Falls, Pa.
*Osgood Co., The, Marion, O.
Austin Machinery Corp'n, Muskegon, Mich.
Bellwood Steam Shovel Co., Bellwood, Pa.
Browning Co., Cleveland, O.
Bucyrus Co., South Milwaukee, Wis.
Byers Machine Co., J. F., Ravenna, Ohio.
Erie Steam Shovel Co., Erie, Pa.
Fairbanks Steam Shovel Co., Marion, O.
Industrial Works, Bay City, Mich.
Marion Steam Shovel Co., Marion, O.
Orton & Steinbrenner Co., Chicago, Ill.
Thew Shovel Co., Lorain, O.

SIGNS, STREET AND ROAD
Automatic Signal & Sign Co., Chicago, Ill.
Baltimore Enamel & Novelty Co., Baltimore, Md.
Century Sign Co., Boston, Mass.
Elkhart Fdry. & Mach. Co., Elkhart, Ind.
Ingram-Richardson Mfg. Co., Beaver Falls, Pa.
Lyle-Signs, Minneapolis, Minn.
Municipal Street Sign Co., New York.
Nelke Sign Co., J. L., New York.
Union Iron Products Co., East Chicago, Ind.
Western Display & Mfg. Co., St. Paul, Minn.

SIGNS, TRAFFIC
Adams & Westlake, Chicago, Ill.
Automatic Signal & Sign Co., Chicago, Ill.
American Gas Accumulator Co., Elizabeth, N. J.
Elkhart Fdry. & Mach. Co., Elkhart, Ind.
Esseo Mfg. Co., Peoria, Ill.
General Electric Co., Schenectady, N. Y.
Griswold Safety Signal Co., Minneapolis, Minn.
Klug & Smith Co., Milwaukee, Wis.
Lebanon Machine Co., Lebanon, N. H.
Line Material Co., So. Milwaukee, Wis.
Little Giant Co., Mankato, Minn.
Lyle-Signs, Minneapolis, Minn.
Ohio Traffic Devices Co., Columbus, O.
Traffic Sign & Signal Co., Gloucester, Mass.
Traffic Signal Corp., New York.
Union Iron Products Co., E. Chicago, Ind.

SLATE, ROOFING
Vendor Slate Co., Inc., Easton, Pa.

SLATE, STRUCTURAL
Keenan Structural Slate Co., Bangor, Pa.
Penna. Structural Slate Co., Easton, Pa.
Phoenix Slate Co., Windgap, Pa.
Structural Slate Co., Pen Argyl, Pa.

SLEEVES, TAPPING AND VALVE
Mueller Company, Decatur, Ill.
Rensselaer Valve Co., Troy, N. Y.
Smith Mfg. Co., A. P., East Orange, N. J.

SLUICE GATES. (See Gates, Sluice)

SMOKE STACKS. (See Stacks, Steel)

SNOW CLEANING MACHINERY
*Austin-Western Road Machy. Co., Chicago, Ill.
*Baker Mfg. Co., Springfield, Ill.
*Good Roads Mach. Co., Kennett Square, Pa.
*Holt Mfg. Co., Peoria, Ill.
*International Motor Co., New York.
*Monarch Tractors, Inc., Watertown, Wis.
Barber-Greene Co., Aurora, Ill.
Cleveland Tractor Co., Cleveland, Ohio.
Toy Co., W. M., Sidney, Ohio.
Union Iron Wks., Inc., Bangor, Me.
Owensboro Ditcher & Grader Co., Owensboro, Ky.

SPADES (See Shovels)

SPRAYERS, ASPHALT AND TAR
*Kinney Mfg. Co., Boston, Mass.

SPRAYING MACHINERY FOR TREES
Bean Spray Pump Co., Lansing, Mich.
Deming Co., The, Salem, Ohio.
Field Force Pump Co., Elmira, N. Y.
Fitzhenry-Guptill Co., East Cambridge, Mass.

SPREADERS, STONE
*Austin-Western Road Mchy. Co., Chicago, Ill.
*Burch Plow Works Co., Crestline, O.

STACKS, STEEL
*Blaw-Knox Co., Pittsburgh, Pa.
*Connery & Co., Inc., Philadelphia, Pa.
*Heil Co., The, Milwaukee, Wis.
*Littleford Bros., Cincinnati, O.
Birmingham Tank Co., Birmingham, Ala.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
Honhorst Co., Jos., Cincinnati, O.
Petroleum Iron Works Co., Sharon, Pa.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Scaife & Sons Co., Wm. B., Pittsburgh, Pa.
Walsh & Weidner Boiler Co., Chattanooga, Tenn.

STANDPIPES, TANKS AND TOWERS
*Connery & Co., Inc., Philadelphia, Pa.
Caldwell Co., W. E., Louisville, Ky.
Chattanooga Blr. & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
Lancaster Iron Wks., Lancaster, Pa.
Pacific Tank & Pipe Co., San Francisco, Cal.
Petroleum Iron Works Co., Sharon, Pa.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
United Iron Works, Inc., Kansas City, Mo.
Walsh & Weidner Boiler Co., Chattanooga, Tenn.

STEAM SHOVELS. (See Shovels, Steam)

STEAM TURBINES. (See Turbines.)

STEEL PLATE CONSTRUCTION
*Blaw-Knox Co., Pittsburgh, Pa.
*Connery & Co., Philadelphia, Pa.
*Heil Co., The, Milwaukee, Wis.
*Littleford Bros., Cincinnati, O.
Bethlehem Steel Co., Bethlehem, Pa.
Biggs Boiler Wks., Akron, O.
Birmingham Tank Co., Birmingham, Ala.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
Graver Corporation, E. Chicago, Ind.
Heltzel Steel Form & Iron Co., Warren, O.
Hendrick Mfg. Co., Carbondale, Pa.
Honhorst Co., Jos., Cincinnati, Ohio.
McClintic-Marshall Co., Pittsburgh, Pa.
Pennsylvania Bridge Co., Beaver Falls, Pa.
Petroleum Iron Works Co., Sharon, Pa.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Riter-Conley Co., Pittsburgh, Pa.
Scaife & Sons, Wm. B., Pittsburgh, Pa.
Toledo Crane Co., Toledo, O.
Union Iron Works, Hoboken, N. J.
Vulcan Iron Works, Jersey City, N. J.
Walsh & Weidner Boiler Co., Chattanooga, Tenn.

STOKERS, MECHANICAL
Automatic Furnace Co., Dayton, Ohio.
Babcock & Wilcox Co., New York.
Combustion Engine Corp., New York.
Detroit Stoker Co., Detroit, Mich.
Laclede-Christy Clay Prod. Co., St. Louis, Mo.
Sanford Riley Stoker Co., Worcester, Mass.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

STREET AND ROAD SIGNS. (See Signs, Street and Road.)

The Central Highway, North Carolina.

A SINGLE HIGHWAY

with 120 miles of TEXACO

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Cleveland

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Kansas City
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Minneapolis
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STREET CLEANERS' CARTS

Durlach Can & Iron Works, Brooklyn, N. Y.
Rochester Can Co., Rochester, N. Y.
Tarrant Mfg. Co., Saratoga Springs, N. Y.

STREET FLUSHERS AND SPRINKLERS

*Austin-Western Road Machy. Co., Chicago, Ill.
*General Motors Truck Co., Pontiac, Mich.
*Heil Co., The, Milwaukee, Wis.
*Kinney Mfg. Co., Boston, Mass.
*International Motor Co., New York.
Autocar Co., Ardmore, Pa.
Etnyre & Co., E. D., Oregon, Ill.
Hoass & Co., Chas., New York.
Federal Motor Truck Co., Detroit, Mich.
Municipal Supply Co., South Bend, Ind.
Pierce-Arrow Motor Car Co., Buffalo, N. Y.
White Co., Cleveland, O.

STREET LAMP POSTS

American Concrete Prod. Co., Chicago, Ill.
Chicago Concrete Post Co., Chicago, Ill.
Clow & Sons, J. B., Chicago, Ill.
Drake Mfg. Co., Friendship, N. Y.
Electric Railway Equipment Co., Cincinnati, O.
General Electric Co., Schenectady, N. Y.
King Mfg. Co., Chicago, Ill.
Mott Iron Wks., J. L., New York.
Union Metal Mfg. Co., Canton, O.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

STREET SIGNS (See Signs, Street)

STREET SWEEPERS

*Austin-Western Road Mchy. Co., Chicago, Ill.
*Good Roads Mach. Co., Kennett Square, Pa.
*Kinney Mfg. Co., Boston, Mass.
*Universal Road Machinery Co., Kingston, N. Y.
Butler Mfg. Co., Cleveland, O.
Elgin Sales Corp'n, New York.
Foamite-Childs Corp., Utica, N. Y.

STREET SWEEPING BROOMS

*Littleford Bros., Cincinnati, O.
Holcomb Mfg. Co., J. I., Indianapolis, Ind.
Ind. Brush & Broom Mfg. Co., Indianapolis, Ind.
Kendallville Broom & Brush Co., Kendallville, Ind.
Lang Broom Co., Pittsburgh, Pa.
Lay Co., Jos., Ridgeville, Ind.
Milwaukee Brush Mfg. Co., Milwaukee, Wis.
Osborn Mfg. Co., Cleveland, Ohio.

STREET SWEEPING BROOMS REFILLED

Kendallville Broom & Brush Co., Kendallville, Ind.
Lang Broom Co., Pittsburgh, Pa.
Osborn Mfg. Co., Cleveland, Ohio.

STRUCTURAL STEEL AND IRON. (See Bridges

STUMP PULLERS

Clyde Iron Wks. Sales Co., Duluth, Minn.
Bennett & Co., H. L., Westerville, O.
La Plant-Choate Mfg. Co., Cedar Rapids, Ia.
Thomas Elevator Co., Chicago, Ill.

SUBGRADING MACHINES

The Hug Co., Highland, Ill.

SUPERHEATERS

Babcock & Wilcox Co., New York.
Power Specialty Co., New York.
Superheater Co., New York.

SURVEYORS' INSTRUMENTS. (See Instruments.)

SWITCHBOARDS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Wagner Elec. Mfg. Co., St. Louis, Mo.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

TABLES AND BOARDS, DRAWING. (See Drawing Materials.)

TAMPING MACHINES

*Pawling & Harnischfeger Co., Milwaukee, Wis.
Ingersoll-Rand Co., New York.

TANKS, AIR COMPRESSOR

*Connery & Co., Inc., Philadelphia, Pa.
*Curtis Pneumatic Mchy. Co., St. Louis, Mo.
*Heil Co., Milwaukee, Wis.
*Littleford Bros., Cincinnati, O.
Abendroth & Root Mfg. Co., New York.
Biggs Boiler Wks., Akron, O.
Birmingham Tank Co., Birmingham, Ala.
Chicago Bridge & Iron Works, Chicago, Ill.
Chicago Pneumatic Tool Co., New York.
Graver Corporation, E. Chicago, Ind.
Indiana Air Pump Co., Indianapolis, Ind.
Ingersoll-Rand Co., New York.
Lancaster Iron Wks., Lancaster, Pa.
National Tube Co., Pittsburgh, Pa.
Petroleum Iron Works Co., Sharon, Pa.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Scaife & Sons Co., W. B., Pittsburgh, Pa.
Westinghouse Tract. Brake Co., Wilmerding, Pa.
Worthington Pump & Machy. Corp., New York.

TANKS, STEEL

*Connery & Co., Philadelphia, Pa.
*Heil Co., Milwaukee, Wis.
*Littleford Bros., Cincinnati, O.
Biggs Boiler Wks., Akron, O.
Birmingham Tank Co., Birmingham, Ala.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Case Threshing Mach. Co., J. I., Racine, Wis.
Caldwell Co., W. E., Louisville, Ky.
Chatta. Boiler & Tank Co., Chattanooga, Tenn.
Chicago Bridge & Iron Works, Chicago, Ill.
Columbian Steel Tank Co., Kansas City, Mo.
Dover Boiler Wks., New York.
Farrell Mfg. Co., Joliet, Ill.
Fouts Co., C. C., Middletown, O.
Graver Corporation, E. Chicago, Ind.
Hardesty Mfg. Co., R., Denver, Col.
Hendrick Mfg. Co., Carbondale, Pa.
Honhorst Co., Jos., Cincinnati, Ohio.
Lancaster Iron Works, Lancaster, Pa.
Pacific Tank & Pipe Co., San Francisco, Cal.
Petroleum Iron Works Co., Sharon, Pa.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
Riter-Conley Co., Pittsburgh, Pa.
Scaife & Sons, Wm. B., Oakmont, Pa.
United Iron Works, Inc., Kansas City, Mo.
Walsh & Weidner Boiler Co., Chattanooga, Tenn.
Wayne Tank & Pump Co., Ft. Wayne, Ind.

TANKS, WOOD

Caldwell Co., W. E., Louisville, Ky.
Davis & Son, G. M., Palatka, Fla.
Eagle Tank Co., Chicago, Ill.
Hauser-Stander Tank Co., Cincinnati, O.
Kalamazoo Tank & Silo Co., Kalamazoo, Mich.
National Tank & Pipe Co., Portland, Ore.
Pacific Tank & Pipe Co., San Francisco, Cal.
Redwood Manufacturers Co., San Francisco, Calif.
Stearns Lumber Co., A. T., Boston, Mass.
U. S. Wind Engine & Pump Co., Batavia, Ill.
Wendnagel & Co., Chicago, Ill.

TANK WAGONS

*Acme Road Mach. Co., Frankfort, N. Y.
*Heil Co., Milwaukee, Wis.
*International Motor Co., New York.
Birmingham Tank Co., Birmingham, Ala.
Butler Mfg. Co., Minneapolis, Minn.
Case Threshing Mach. Co., J. I., Racine, Wis.

TAPES, STEEL AND METALLIC

*Lufkin Rule Co., Saginaw, Mich.
Dietzgen Co., Eugene, New York.
Keuffel & Esser Co., Hoboken, N. J.
Starrett, L. S., Athol, Mass.

TAPPING MACHINES

Hays Mfg. Co., Erie, Pa.
Mueller Co., Decatur, Ill.
Smith Mfg. Co., A. P., E. Orange, N. J.

TAR

*Barrett Co., New York.
American Tar Products Co., Chicago, Ill.

TAR KETTLES. (See Kettles)

TIES, STEEL

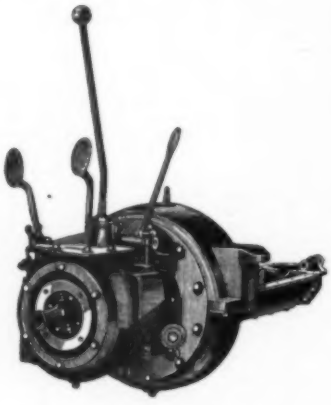
*Koppel Ind. Car & Equip. Co., Koppel, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Sweet's Steel Co., Williamsport, Pa.

TIMBER CLAMPS

Pyle-Rogers Corp., New York.

TIRES, RUBBER. (For Motor Trucks.)

*Goodrich Rubber Co., Akron, O.
Firestone Tire & Rubber Co., Akron, O.
Fisk Tire Co., Chicopee Falls, Mass.
Goodyear Tire & Rubber Co., Akron, O.



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U. S. Tire Co., New York.

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*Littleford Bros., Cincinnati, O.

TOWERS. (See Standpipe, Tanks and Towers)

TRACKS, INDUSTRIAL AND PORTABLE
*Easton Car & Constr. Co., New York
*Koppel Ind. Car & Equip. Co., Koppel, Pa.
Atlas Car & Mfg. Co., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Chase Fdry. & Mfg. Co., Columbus, O.
Hunt Co, Inc., C. W., West New Brighton, N. Y.
Lakewood Engineering Co., Cleveland, O.
Sweet's Steel Co., Williamsport, Pa.

TRACTORS
*Best Tractor Co., C. L., San Leandro, Cal.
*Ford Motor Co., Detroit, Mich.
*Holt Mfg. Co., Peoria, Ill.
*Huber Mfg. Co., Marion, O.
*International Motor Co., New York.
Advance-Rumeley Thresher Co., Laporte, Ind.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Bates Machine & Tractor Co., Joliet, Ill.
Bear Tractors, Inc., New York
Case Threshing Machine Co., J. I., Racine, Wis.
Clark Tructractor Co., Chicago, Ill.
Cleveland Tractor Co., Cleveland, O.
Emerson-Brantingham, Rockford, Ill.
Hart-Parr Co., Charles City, Iowa.
International Harvester Co., Chicago, Ill.
J. T. Tractor Co., Cleveland, O.
Kinnard & Haines, Minneapolis, Minn.
John Lauson Co., New Holstein, Wis.
The Minneapolis Line, Minneapolis, Minn.
Monarch Tractors, Inc., Watertown, Wis.
Shaw-Enochs Tractor Co., Minneapolis, Minn.
Tioga Tractor Co., Baltimore, Md.
Toro Mfg. Co., Minneapolis, Minn.
Twin City Co., Minneapolis, Minn.

TRAFFIC LINE MARKERS
Hampden Supply Co., Springfield, Mass.
Highway Appliance Co., Inc., Providence, R. I.
Line-O-Graph Co., New York.
Spray Painting & Finishing Equip. Sales Co., Boston, Mass.

TRAFFIC PAINT
Hoosier Paint Wks., Ft. Wayne, Ind.
Sewall Paint & Glass Co., Kansas City, Mo.
Tropical Paint & Oil Co., Cleveland, Ohio.
Truscon Laboratories, Detroit, Mich.

TRAFFIC SIGNS. (See "Signs, Traffic")

TRAILERS FOR TRUCKS AND TRACTORS
*Miami Trailer-Scraper Co., Troy, Ohio.
Arcadia Trailer Corp., Newark, N. Y.
Eagle Wagon Works, Auburn, N. Y.
Highway Trailer Co., Edgerton, Wis.
La Plant-Choate Mfg. Co., Cedar Rapids, Ia.
Lee Trailer & Body Co., Chicago, Ill.
Troy Wagon Works, Troy, O.
Warner Mfg. Co., Beloit, Wis.
Watson Products Corp'n, Canastota, N. Y.
Whitehead & Kales Co., Detroit, Mich.

TRAILERS, INDUSTRIAL
Chase Fdry. & Mfg. Co., Columbus, O.
Electric Wheel Co., Quincy, Ill.
Lakewood Engineering Co., Cleveland, O.
Lee Trailer & Body Co., Chicago, Ill.

TRAMWAYS, AERIAL WIRE ROPE
Broderick & Bascom Rope Co., St. Louis, Mo.
Leschen & Sons Rope Co., A., St. Louis, Mo.

TRANSFORMERS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Duncan Elec. Mfg. Co., Lafayette, Ind.
Enterprise Electric Co., Warren, Ohio.
General Electric Co., Schenectady, N. Y.
Kuhlman Electric Co., Bay City, Mich.
Maloney Electric Co., St. Louis, Mo.
Packard Electric Co., Warren, Ohio.
Pittsburgh Transformer Co., Pittsburgh, Pa.
Wagner Electric Corp., St. Louis, Mo.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

TRANSITS AND LEVELS. (See Instruments.)

TRANSMISSION. (Auxiliary for Ford Trucks.)
*Warford Corpn., New York.

TRANSMISSION MACHINERY, POWER
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Chain Belt Co., Milwaukee, Wis.
Dodge Mfg. Corp'n, Mishawaka, Ind.
General Electric Co., Schenectady, N. Y.
Link-Belt Co., Chicago, Ill.
Webster Mfg. Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

TRASH CANS. (See Cans)

TREADS, SAFETY
American Abrasive Metals Co., New York.
American Mason Safety Tread Co., Lowell, Mass.
Concrete Steel Co., New York.
Norton Co., Worcester, Mass.

TRENCH PUMPS. (See Pumps, Contractors')

TRENCH EXCAVATORS, (See Excavators Ditch & Trench)

TRENCH PUMPS. (See Pumps, Contractors')

TURBINES
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
De Laval Steam Turbine Co., Trenton, N. J.
General Electric Co., Schenectady, N. Y.
Ingersoll-Rand Co., New York.
Terry Steam Turbine Co., Hartford, Conn.
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

TURNTABLES FOR MOTOR TRUCKS
*Blaw-Knox Co., Pittsburgh, Pa.
Champion Eng. Co., Kenton, O.
Easton Car & Const'n Co., Easton, Pa.
Freeman Mfg. Co., Racine, Wis.
The Hug Co., Highland, Ill.
Western Structural Co., Moline, Ill.

VALVE CONTROL APPARATUS, ELECTRIC
Payne Dean, Ltd., New York.

VALVES, CHECK
*Ludlow Valve Mfg. Co., Troy, N. Y.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Coffin Valve Co., Boston, Mass.
Michigan Valve & Fdry. Co., Detroit, Mich.
Rensselaer Valve Co., Troy, N. Y.

VALVES, GATE AND INDICATOR POSTS
*Ludlow Valve Mfg. Co., Troy, N. Y.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Coffin Valve Co., Boston, Mass.
Columbian Iron Wks., Chattanooga, Tenn.
Crane Company, Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Eddy Valve Co., Waterford, N. Y.
Fairbanks Co., The, New York.
Iowa Valve Co., Oskaloosa, Ia.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Rensselaer Valve Co., Troy, N. Y.
Smith Mfg. Co., A. P., East Orange, N. J.
Wood & Co., R. D., Philadelphia, Pa.

VALVES, TAPPING & SLEEVES (See "Sleeves")

VALVE BOXES AND HOUSINGS
*Central Foundry Co., New York.
*Ludlow Valve Mfg. Co., Troy, N. Y.
*U. S. C. Ir. Pipe & Fdry. Co., Burlington, N. J.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Clark Co., H. W., Mattoon, Ill.
Clow & Sons, J. B., Chicago, Ill.
Columbian Iron Works, Chattanooga, Tenn.
Darling Valve & Mfg. Co., Williamsport, Pa.
Eddy Valve Co., Waterford, N. Y.
Fairbanks Co., The, New York.
Iowa Valve Co., Oskaloosa, Ia.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Mueller Mfg. Co., H., Decatur, Ill.
Rensselaer Valve Co., Troy, N. Y.
Smith Mfg. Co., A. P., East Orange, N. J.
Wood & Co., R. D., Philadelphia, Pa.

VENTILATORS
American Blower Co., Detroit, Mich.
Edwards Mfg. Co., Cincinnati, O.
Milwaukee Corrugating Co., Milwaukee, Wis.

WAGONS. (See Dump Carts and Wagons.)

WAGON BODIES. (See Dump Bodies.)

WAGON LOADERS. (See Loaders, Gravel and Wagon)

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The selection of Climax Engines to provide the "power that would not fail" in landing the Shenandoah was justified, and is just one more significant example of the absolute confidence men who know engines have come to place in—

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Three Climax Engines power the landing gear machinery at Camp Lewis, Washington, and three in the Hawaiian Islands.

Regarding this Climax performance, the Pacific Hoist & Derrick Company writes:

"With reference to the landing of the Shenandoah, we understand that this is the first successful landing made on any tower in the United States. There were no hitches in the operation of the landing gear; all the engines were running in perfect shape. The landing was made in the early morning hours, and on Sunday the Shenandoah flew over the city of Seattle on her return trip to Lakehurst, New Jersey."

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All Types and Sizes

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Cornell Wood Products Co., Chicago, Ill.
Haverhill Box Board Co., Haverhill, Mass.
MacAndrews & Forbes Co., New York.
Plastergon Wall Board Co., Buffalo, N. Y.
United States Gypsum Co., Chicago, Ill.
Upson Co., The, Lockport, N. Y.
Waldorf Paper Products Co., St. Paul, Minn.

WALL TIES
Concrete Steel Co., New York.
Consolidated Expanded Metal Co., Braddock, Pa.
Berger Mfg. Co., Canton, O.
Milwaukee Corrugating Co., Milwaukee, Wis.
Niagara Metal Stamp. Corp., Niagara Falls, N. Y.

WATER MAIN CLEANING
*National Water Main Cleaning Co., New York.

WATER MAIN TAPPING MACHINES
Hays Mfg. Co., Erie, Pa.
Mueller Mfg. Co., H., Decatur, Ill.
Smith Mfg. Co., A. P., East Orange, N. J.

WATER METERS (See Meters, Water)

WATERPROOFING COMPOUNDS AND MATERIAL
*Barber Asphalt Co, Philadelphia, Pa.
*Barrett Company, New York.
*Carey Co., Philip, Cincinnati, Ohio.
*Standard Oil Co. (Indiana), Chicago, Ill.
*Texas Company, New York.
Anti-Hydro Waterproofing Co., Newark, N. J.
Atlantic Refining & Asphalt Corp., Phil'a, Pa.
General Fireproofing Co., Youngstown, O.
Master Builders' Co., Cleveland, O.
Minwax Co., The, New York.
Protexol Corpn., New York.
Ruberoid Co., New York.
Sandusky Cement Co., Cleveland, O.
Sonneborn Sons, Inc., New York.
Toch Brothers, New York.
Truscon Laboratories, Detroit, Mich.

WATER PURIFICATION. (See also Filters.)
*Wallace & Tiernan Co., Inc., Newark, N. J.
Empire Electric & Meter Co., Inc., New York
R. U. V. Company, New York.

WATER REGULATORS
*Union Water Meter Co., Worcester, Mass.
Mueller Company, Decatur, Ill.
Pacific Flush Tank Co., Chicago, Ill.

WATER SOFTENERS
American Water Softener Co., Philadelphia, Pa.
Graver Corporation, E. Chicago, Ind.
International Filter Co., Chicago, Ill.
Permutit Company, New York.
Roberts Filter Mfg. Co., Darby, Pa.
Scaife & Sons, W. B., Pittsburgh, Pa.
Wayne Tank & Pump Co., Ft. Wayne, Ind.

WATER WASTE DETECTION
*Pitometer Co., New York.
Empire Electric & Water Co., Inc., New York.
Simplex Valve & Meter Co., Philadelphia, Pa.

WATER WHEELS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Cramp & Sons Ship & Eng. Bldg. Co., Wm., (I. P. Morris Dept.), Philadelphia, Pa.
Leffel & Co., Jas., Springfield, O.
Newport News Shipbldg. & Dry Dock Co., Newport News, Va.
Pelton Water Wheel Co., San Francisco, Cal.
Smith Company, S. Morgan, York, Pa.
Worthington Pump & Machy. Corp., New York

WATER WORKS PUMPS. (See "Pumps, Centrifugal" and "Pumps, Deep Well")

WELDING APPARATUS
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General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., Cleveland, O.
Milburn Company, Alex., Baltimore, Md.
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U. S. Light & Heat Corp., Niagara Falls, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

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WELLS, CONCRETE
Kelly Well Co., Grand Island, Neb.

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American Well Works, Aurora, Ill.
Armstrong Mfg. Co., Waterloo, Iowa.
Leidecker Tool Co., Marietta, Ohio.
Loomis Machine Co., Tiffin, Ohio.
Sanderson Cyclone Drill Co., Orrville, Ohio.
Sparta Iron Wks. Co., Sparta, Wis.
Star Drilling Machine Co., Akron, O.

WHEELBARROWS
*Puffer-Hubbard Mfg. Co., Minneapolis, Minn.
Akron Barrow Co., Cleveland, O.
Jackson Mfg. Co., Harrisburg, Pa.
Chattanooga Wheelbarrow Co., Chattanooga, Tenn.
Cleveland Wheelbarrow Co., Cleveland, Ohio
Fairbanks Co., New York.
Lansing Co., Lansing, Mich.
Sidney Steel Scraper Co., Sidney, O.
Sterling Wheelbarrow Co., Milwaukee, Wis.
Toledo Wheelbarrow Co., Toledo, O.
Western Wheelbarrow Co., Asheboro, N. C.

WINCHES
Bethlehem Shipbuilding Corp., Bethlehem, Pa.
Chisholm-Moore Mfg. Co., Cleveland, O.
Clyde Iron Wks. Sales Co., Duluth, Minn.
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
Lidgerwood Mfg. Co., New York.
Mead-Morrison Mfg. Co., E. Boston, Mass.
Mundy Hoisting Eng. Co., J. S., Newark, N. J.

WINDOW FRAMES AND SASH. (Metallic.)
*Truscon Steel Co., Youngstown, O.
Bayley Co., Wm., Springfield, O.
Detroit Steel Products Co., Detroit, Mich.
Friedrick Co., E. H., Holyoke, Mass.
Lupton's Sons Co., David, Philadelphia, Pa.
McFarland Co., J. C., La Porte, Ind.
Penn Metal Co., Boston, Mass.
Sykes Co., Chicago, Ill.

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Copperweld Steel Co., Braddock P. O., Rankin, Pa.
General Electric Co., Schenectady, N. Y.
Habirshaw Elec. Cable Co., Inc., N. Y.
Hazard Mfg. Co., Wilkesbarre, Pa.
Macwhyte Co., Kenosha, Wis.
National India Rubber Co., Bristol, R. I.
New York Insulated Wire Co., New York.
Okonite Co., Passaic, N. J.
Roebling's Sons Co., J. A., Trenton, N. J.
Safety Ins. Wire & Cable Co., New York.
Simplex Wire & Cable Co., Boston, Mass.
Standard Underground Cable Co., Pittsburgh, Pa.
Tubular Woven Fabric Co., Pawtucket, R. I.
Waterbury Co., New York.
Williamsport Wire Rope Co., Williamsport, Pa.
Youngstown Sheet & Tube Co., Youngstown, O

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WIRE MESH REINFORCEMENT
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National Steel Fabric Co., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

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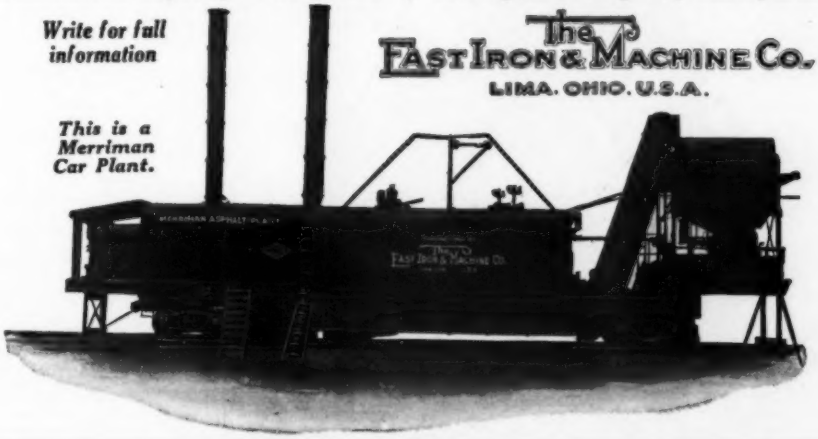

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Caisson Foundations in Detroit

By Frederick B. Spencer
The Spencer, White and Prentis Company, New York and Detroit

FOUNDATION conditions are such in Detroit that for the smaller buildings there is practically no foundation problem, while for the larger buildings the problem is serious. In general, the soil is a heavy blue clay, which weighs between 130 and 140 pounds per cubic foot. For the smaller buildings, the general procedure is to use spread footings and shallow cellars, with either no sheeting at all or sheeting only at points where the ground shows a tendency to slip. For the larger buildings the loads are such that it is practically impossible to design a spread footing foundation, so that other means of carrying the loads must be used.

GENERAL VIEW OF FOUNDATION WORK ON BOOK-CADILLAC HOTEL, SHOWING RETAINING WALLS AND THE METHOD OF BRACING

LOOKING DOWN A 120-FOOT CAISSON IN THE FOUNDATION OF THE BOOK-CADILLAC HOTEL

In the down-town section the caisson type of foundation has been used recently with success in the cases of the Book Cadillac Hotel, the J. L. Hudson Company Store, the Buhl Building and the Detroit Free Press Building. There have been few other large buildings built in Detroit in the last two years.

Caisson Foundations

These caissons are sunk by methods similar to those used in Chicago. A circular pit is dug, the diameter varying with the load to be carried, and the depth varying from 4 to 6 feet, depending on the nature of the soil. Tongued and grooved sheeting is then set up inside the pit and supported by steel hoops, which are wedged and braced against the sheeting. This method is con-

ARCHITECT'S SKETCH OF BOOK-CADILLAC HOTEL, DETROIT, MICH.

tinued downward until the desired depth is reached. Where soft material is encountered, such that it is impossible to dig any considerable depth with the soil self-sustaining, the method is modified by increasing the diameter of the shaft in the firm material above the soft stratum and driving the sheeting through the soft material.

The Book-Cadillac Hotel

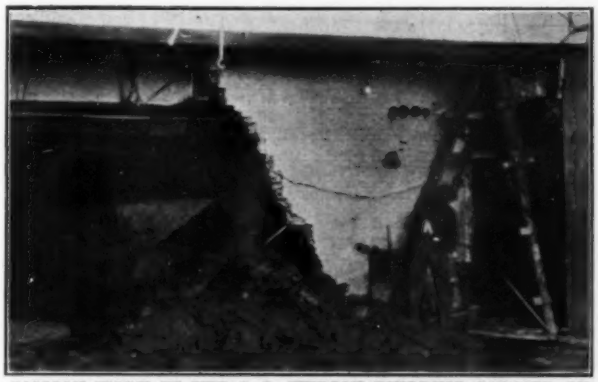
The Book-Cadillac Hotel is a twenty-nine-story building, the tallest hotel building in the world. This building was originally designed for a mat or spread footing covering the entire area of the lot, but changes in the layout in the basement rendered the mat design not feasible and the change was made to use caissons. In this case the caissons were carried to hard-pan at a depth of about 120 feet below curb. As far as the author knows, this is the only building in Detroit where the caissons were carried to hard-pan. The hard-pan is a very hard stratum of clay, sand and gravel, which has the appearance and consistency of a concrete mixed with Rosendale cement. Rock could have been reached by carrying the caissons about 12 feet deeper, but between the hard-pan and the rock there is a thin stratum of gravel, in which is found water under a head of over 100 feet. This water has dissolved in it in large quantities of hydrogen sulphide gas. Therefore, had an attempt been made to reach the rock, the use of compressed air would have been necessary and the expense of the job greatly increased.

The caissons were designed on a basis of 40 tons per square foot on the shaft, the concrete being mixed in the proportions of 1:1:2, but a minimum diameter of 5 feet was adopted. The bearing on the hard-pan was designed on the basis of 7 tons per square foot, and the increase in the size was obtained by belling out in the clay overlying this stratum. To reduce the number of caissons, reinforced concrete girders were used to combine the loads of the lighter columns. The general excavation over the entire area of the lot was carried to a depth of 31 feet below curb, and for the boiler room, which covers an area of approximately one-third of the total, the excavation was carried to a depth of 51 feet below curb.

The second illustration shows a view looking down one of the deep caissons. Note the horizontal sheeting at the top of the caisson, which was used in getting down through rough fill to the level where the caisson was to be started.

One of the features of this job was the fact that the retaining walls on the street sides were installed in trenches in advance of the general excavation, so that the steam-shovel work was not delayed by the work of sheeting the banks. However, the extreme depths of the excavation made the work of shoring and bracing the three retaining walls and of the sheeting on the alley side of the property a considerable problem. The amount of timber used and the extreme depth of the excavation are shown in the first illustration.

ARCHITECT'S SKETCH OF THE J. L. HUDSON BUILDING



CAISSON WORK IN THE J. L. HUDSON BUILDING CARRIED ON DURING THE WRECKING OPERATIONS

Louis Kamper was the architect for this building, and the general contractors were the Starrett Brothers, of Michigan. The Spencer, White & Prentis Company installed the foundations.

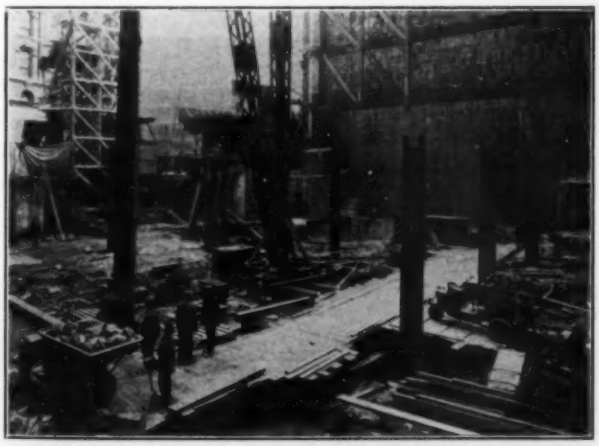
The J. L. Hudson Company Store

The J. L. Hudson Company store presented, in addition to the ordinary construction problem, the problem of constructing a building on an unusual time schedule.

The building is being built in two parts, the north half being built this year and the south half to be built in 1925. In neither case could any work be started until after the Christmas season, and the new building must be ready before the next Christmas. The foundations were so designed that the work of installing them could be done simultaneously with the wrecking of the old structure, and the erection of the structural steel could be started almost immediately upon the completion of the wrecking.

Prior to the start of any of the operations, the building to the north of this property was underpinned in an unusual manner. Working in the cellar of the existing hotel while it was occupied, the contractors installed the underpinning in pits, which were reached by tunneling under the walls of the existing hotel building. This underpinning was installed to a depth of 55 feet below the curb level, while the retaining wall of the new building was installed along the same side of the property. This work was entirely completed prior to the start of the wrecking of the hotel building. A saving in time of not less than six weeks was effected by the use of this method. The buildings across the alley were also underpinned prior to the general excavation, by means of pits sunk from the alley level.

EXCAVATING WITH COMPRESSED-AIR SHOVEL IN THE J. L. HUDSON BUILDING AFTER THE ERECTION OF THE STRUCTURAL STEEL



GENERAL VIEW OF THE J. L. HUDSON BUILDING JUST AFTER THE COMPLETION OF THE WRECKING OF THE OLD STRUCTURE, SHOWING 50-FOOT STEEL COLUMNS ERECTED IN PLACE IN THE CAISSONS

Caissons were sunk from the existing basement to a depth of 80 to 95 feet below the existing curb levels.

Bearing was obtained by the use of multiple bells in firm blue clay. These caissons were then concreted to the proper elvations. After the wrecking was completed, the steel columns were erected in the caissons and the work on the superstructure started at once. After the basement floor steel was in place and the concreting of the floor was partly completed, the general excavation was started, and it was eventually carried to

ARCHITECT'S SKETCH OF BUHL BUILDING

a depth of 45 feet below curb. This excavation was removed by means of a redesigned steam shovel from which the boiler had been removed and which was driven by compressed air. The shovel was of such a size that it could be operated in between the steel columns. The earth from the caissons as well as that of the steam shovel excavation, was handled by means of Clark Tructractors to a double-bucket elevator, which hoisted the muck to loading-hoppers on the street. Inasmuch as a large part of the work was done in the winter, the capacity of these hoppers was about one truck load, so there would be no danger of the wet clay's freezing in the hopper.

On two sides of this operation there were existing retaining walls, which extended to a depth of about 13 feet below curb. Trenches were sunk below these walls to the final depth of about 45 feet, and the new walls installed. The joint between the new and the old wall was arranged to come at the level of the basement floor, the thrust at this point being carried directly by the floor system. The method used was similar to that of the Book-Cadillac Hotel, except that, instead of the heavy timbering across the lot, the wall was braced directly against the steel framing as the excavating progressed.

Smith, Hinchman & Grylls are the architects of this building, the general contractors being the Bryant & Detwiler Company. The foundation work as above was installed by The Spencer, White & Prentis Company.

The Buhl Building

The Buhl Building is now under construction and will be the tallest office building in Detroit. The foundations of this building are caissons carried to a depth of about 70 feet, bearing being obtained by multiple bells spread out in firm blue clay. This is the same type of foundation as that of the J. L. Hudson Company store. However, only a single basement was used.

Smith, Hinchman & Grylls are the architects for this building, and Davis & McGonigle are the general contractors. The foundation work was installed by the general contractors.

The Detroit Free Press Building

This building will house the printing plant of the *Detroit Free Press*, Detroit's only morning newspaper, as well as provide a large amount of office space. The general excavation of this lot was carried to a depth of about 30 feet prior to the start of the foundation work. The foundation consists of shallow caissons belled out in firm clay. The work also involved the installation of foundations for a large number of presses and other special machinery.

The fact that this building is to be used as a newspaper building, required that the basements be designed to accommodate the presses, which are more than one story high. Therefore, there are a basement and a subbasement on one-half of the building, while on the other half there is a two-story basement to accommodate these presses. There is at this point no support for the retaining walls from the street level to the subbasement floor, the wall being designed for a clear span of 30 feet. This wall was installed in trenches, as in the case of the walls of the Book-Cadillac Hotel and the J. L. Hudson Building.

THE DETROIT FREE PRESS BUILDING, SHOWING THE RETAINING WALL AND METHOD OF BRACING
The erection of steel had just been started when this picture was taken

ARCHITECT'S SKETCH OF THE DETROIT FREE PRESS BUILDING

The retaining walls for the other portion of the building were installed after the completion of the excavation and sheeting.

Albert Kahn is the architect for this building, and the general contractors are The Crowell & Little Construction Company, of Cleveland. The foundations were installed by the Spencer, White & Prentis Company.

Road Show
January 5-9, 1925
at Chicago, Ill.
A. G. C.
January 12-14, 1925
at Washington, D. C.

Full-Size Experimental Arch Dam to be Tested to Destruction

Important Activity of the Engineering Foundation

IN December, 1923, the Committee on Arch Dam Investigation of the Engineering Foundation presented a report in which it formulated a comprehensive program for tests on arch and multiple-arch dams. Suitable instruments for making the necessary measurements were installed on a number of structures, and initial readings were taken on some dams. These readings are to be repeated periodically or whenever the water-level of the reservoir has changed appreciably. In view of the difficulties involved in making periodic measurements on suitable dams, most of which are located far up in the mountains, it was decided to start the investigation on a limited scale. The tests on each of the four dams selected were placed in the immediate charge of a subcommittee of engineers who are particularly familiar with that dam.

Preliminary steps were taken to have laboratory tests made on models. It was realized, however, that accurate tests on small models would involve great difficulties because of the complicated shape of arch and multiple-arch dams and, further, on account of the difficulty of producing accurate load conditions and then measuring the infinitesimally small deformations.

W. A. Brackenridge, Senior Vice-President of the Southern California Edison Company, made the suggestion that a full-size arch dam should be constructed for experimental purposes. Surveys and tentative designs and an estimate of costs were made by the engineers of the Southern California Edison Company for a test dam about 60 feet high. The company also started a fund for the construction and testing of this dam by subscribing $25,000 subject to the condition that the remaining $75,000 required for construction and investigation of the dam be contributed by other sources.

There is a natural location for a test dam at the site proposed by the Southern California Edison Company, and conditions are extremely favorable. The site is on Stevenson Creek, a tributary of the San Joaquin River, at an elevation of about 1,800 feet above sea-level. The foundation conditions will be excellent, the bed-rock consisting of solid granite with practically no overburden. The canyon is approximately V-shaped with fairly regular side slopes. The span of the dam will be about 20 feet at the base and about 110 feet at the 60-foot elevation. The topography of the site is such as to permit raising the dam to 100 feet high, for which the span at the crest will be approximately 170 feet.

The flow of Stevenson Creek is normally diverted a few miles above the proposed dam site by the works of the Southern California Edison Company. However, a power tunnel of this company passes near the dam site and an adit to this tunnel equipped with a large valve and located just above the test dam will make it possible to fill the reservoir in a very short time. These exceedingly favorable conditions will afford perfect control of the height of water in the reservoir without depending on, or being influenced by, the natural flow of the creek.

The construction railroad and roads of the Edison Company pass very near the dam site and thus will afford convenient transportation. At this altitude of the Sierras, neither heavy snows nor ice will interfere seriously with the tests, so that the experiment may be conveniently conducted during all seasons of the year. The dam and reservoir will be located entirely on government land. In case of a break in the dam during the tests, the water released thereby from the reservoir will flow down Stevenson Creek and empty into the San Joaquin River. The capacity of the reservoir will be so small, and the natural conditions below the dam site are so favorable, that no damage will result from the water which would be released by the failure of the test dam.

The tentative design of the dam at present

under consideration is for a single arch with a constant up-stream radius and a vertical up-stream face. It is believed that a variable-radius dam might introduce complications because the lower arches with shorter radii would have a tendency to deflect along different radial lines from the upper arches of longer radii. This might introduce a tendency to twisting of the elementary vertical cantilevers, which might produce stresses exceedingly difficult to separate by the measurements from the pure arch and cantilever action.

It is proposed to build the dam first to a height of 60 feet and test it repeatedly under various load and temperature conditions in the course of about one year. Each set of measurements will be repeated once or twice for checking purposes. The convenient source of water-supply from the tunnel of the Edison Company will facilitate greatly the making of such check measurements on the same or the following day, so that temperature, water content of concrete, and other conditions may be practically the same for each set of tests.

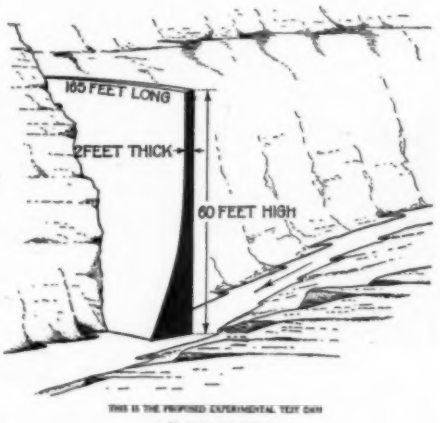
For several months at a time, the reservoir will be left empty so that the dam can dry out thoroughly and respond to temperature changes only. At other times the reservoir will be kept full for considerable periods, and information may thereby be gained on the influence of the flow of concrete, time factor and related problems.

After all the information obtainable from testing the 60-foot dam has been secured, the structure will be raised successively in steps of about 10 feet each time, as often as may be desirable, until eventually failure will occur.

Value of Test

The value of this experiment to the investment banker, the equipment manufacturer, and the construction engineering firm, to the engineer at large, to the conservation movement, and to existing and future developments, is so great that funds are being received by Mr. Brackenridge to insure the $100,000 necessary to carry the experiment to a conclusion. Investment bankers handle the bonds of the utilities in which arch dams may be an important factor, and hence they are as much interested as engineers in the stability, safety and permanence of the investment represented by the bonds they recommend to their clients. Equipment manufacturers are interested because the anticipated outcome of this experiment will lead to greater economies in the design of concrete arch dams, and hydroelectric developments will become possible which, in the present status of dam design, are not now financially feasible. Construction engineering firms will be interested because these data will make possible the rational design of concrete dams, for which there is now no basis except experience and assumption, often extravagantly conservative. About half the fund has been raised. Contributors may have representatives present at the tests.

If any readers of CONTRACTORS' & ENGINEERS' MONTHLY are interested in aiding this notable piece of engineering experimental work, they can secure complete information from Alfred D. Flinn, Director, Engineering Foundation, 29 West 39th Street, New York City, or, if they desire, they may forward their checks for any sum desired to W. A. Brackenridge, Senior Vice-President, Southern California Edison Company, Los Angeles, Calif., who is sole trustee for the collection and distribution of the funds for this proposed experimental arch dam.



COVER OF DESCRIPTIVE FOLDER SENT OUT BY THE COMMITTEE ON ARCH DAM INVESTIGATION, SOLICITING FUNDS FOR THE PROPOSED EXPERIMENTAL TEST DAM

Building the Future City

ZONING is a first essential to the securing of a measure of orderliness in the building of a city. The common sense of the average citizen leads to a degree of order in the home, the store and the factory that is all but lacking in the life and work of the community as a whole. For want of a well-considered plan of building development, each man builds without reference to his neighbor. The result is chaotic. Haphazard growth is inefficient, wasteful and ugly. Why not use the same forethought and care in the building of our community home that each man uses in the building of his individual home or factory? Zoning is the direction of building development along orderly and well-considered lines of city growth. On the economic side, zoning means increased industrial efficiency and the prevention of enormous waste. On the human side, zoning means better homes and an increase of health, comfort and happiness for all the people.—From the Zone Plan for Cranston, R. I., by Robert Whitten, Cleveland.

Legal Points for Contractors

These brief abstracts of court decisions in the contracting fields may aid you in avoiding legal difficulties. Local ordinances or state laws may alter the conditions in your community. If in doubt, consult your own lawyer

Edited by A. L. H. Street, Attorney-at-Law

No Lien for Claim for Damages for Breach of Contract

Said the Appellate Division of the New York Supreme Court in the late case of J. C. Whritenour Company, Inc., vs. Colonial Homes Company, Inc., 205 New York Supplement, 299:

"The theory upon which the Lien Law grants a lien is that the lienor, by his labor or materials, or both, has added to the value of the property upon which a lien is claimed. Damages caused by a breach of the building contract add nothing to the value of the premises upon which the building is being created, and are not within the purview of the Lien Law."

Duty to Furnish and Transport Construction Equipment

Where a party contracts to perform work requiring the use of equipment, it will always be assumed, in the absence of proof of an established custom, or a provision in the contract to the contrary, that such party must furnish and deliver such equipment on the premises where it is to be used, at his own risk and cost, as an act preparatory to the discharge of his contract. (Indiana Appellate Court, Spickelmier Fuel & Supply Company vs. Thomas, 144 Northeastern Reporter, 566.)

Notice for Paving Bids Was Not Vitally Irregular

Failure to comply with a statutory direction to specify in a notice for bids to do municipal paving when the work was to be done, did not invalidate a contract let nor an assessment levied on account of the improvement, held the Iowa Supreme Court in the case of Vowles vs. Town of Kenwood Park, 199 Northwestern Reporter, 1009. On this point the Court said:

"The notice . . . referred to the plans and specifications then on file in the office of the town clerk. No one could submit a bid intelligently from the notice alone, and without recourse to the plans and specifications, in any event. These contained a form of proposal, which was to be used by the bidder, and which provided that the work was to be done by September 1, 1921. Every bidder submitting a bid would, of necessity, not only examine the plans and specifications and ascertain therefrom when the work was to be done, but, by the very terms of the proposal for bids under which his bid was to be submitted, was required to offer to contract to do the work within the time specified therein. No one claims that any prospective bidder was misled by the notice, or failed to bid because of its insufficiency in any respect."

Contractor's Liability for Injuries to Employees

Legal phases of a contractor's responsibility for injury to an employee due to the use of machinery or to carelessness of a fellow employee were lately considered by the North Carolina Supreme Court in the case of Michaux vs. R. G. Lassiter & Co., 123 Southeastern Reporter, 310.

It was held that defendant, a road and street contractor, was not liable for death of an employee, in the operation of a road paver, of standard make and in good order, due to negligence of a co-employee, in whose selection by defendant no negligence was shown, in failing to fasten or in negligently releasing a dumping-pan, which fell on the deceased employee. The Court said:

"It is very generally accepted that in the exercise of reasonable care it is the duty of an employer of labor to provide for his employees a reasonably safe place in which to do their work, to furnish them with appliances and tools suitable for the work in which they are engaged, and also to select employees who are competent and sufficient for such work, and where there is a breach of duty in these respects or any of them, and the same is shown to be the proximate cause of an injury, the employee himself having been without default, an actionable wrong is established. It is also recognized with us, and very generally elsewhere, that, unless otherwise provided by statutes . . . an employer is not responsible for injuries attributable solely to the negligence of a fellow servant."

Contractor's Rights Under Invalid Public Contracts

In a case involving the validity of a contract to construct additions to a school building on a cost-plus basis, which was partly performed before taxpayers secured an injunction against full execution of the agreement, the Minnesota Supreme Court lately said:

"The rule of law applicable to a case where a school district contracts for an improvement which it has power to make, but the contract is void because not made after competitive bidding as required by law, is that the district is obliged to pay for the reasonable value of any benefit it receives through part performance of the contract. . . . The law says, in such cases as this, that the district in equity and good conscience ought to pay. Such being the reason for the imposition of legal liability, the court should not apply technical and narrow rules which might in many cases prevent a recovery." (Williams vs. National Contracting Company, 199 Northwestern Reporter, 919.)

What Constitutes a "Building Site"?

Concerning a building contract, the Louisiana Supreme Court said the other day in the case of Myevre vs. Liberty Realty & Securities Company, 100 Southern Reporter, 694:

"The contract provides for filling the building site to grade. Defendant claims that under this provision it was only required to place filling under the actual building. Plaintiff, on the other hand, claims that the entire lot should have been filled. Defendant filled under the house but not the lot. We think the 'building site' comprehended the lot, and that plaintiff is entitled to recover the amount necessary to complete such filling."

Contractor's Surety's Rights When Materials Are Delayed

Concerning the effect on a contractor's surety's liability of delay on the part of the owner in furnishing materials required by the contractor, the Kentucky Court of Appeals said in the case of Harlan Fuel Company vs. Wiggington, 262 Southwestern Reporter, 957:

"If the plaintiff [owner] was unable to procure the necessary materials and for this reason failed to furnish them, the time so lost by Condra [contractor] was to be added to his time for completing the contract. This is no evidence that the plaintiff was unable to procure the materials. By the contract it was required to 'use due diligence and its best efforts to furnish the materials and machinery.' The materials were to be furnished from day to day as required by the contractor. The company [owner] was not an insurer that everything needed would always be there; but it was required to use due diligence and its best efforts to this end. If it failed to do this, that is, if it failed to use ordinary care in this respect and, but for this, the contractor would have completed the contract as provided thereby, the sureties were released. But if the contractor would not have completed the contract, as required thereby, if there had been no such failure on the part of the plaintiff, the sureties were not released by such failure on its part. In that event the plaintiff would be liable to the contractor for any loss or additional expense caused him thereby, and the sureties would be substituted to the contractor's rights; and the amount of this expense should be deducted from the balance due by the contractor on the settlement of the account."

Duty of Employer to Safeguard Workmen Against Injury

A suit for damages on account of injury sustained by a laborer employed by a contractor in unloading heavy radiators from a freight car gave the St. Louis Court of Appeals occasion for laying down fundamental rules governing the measure of care exacted of employers to safeguard their workers (Clark vs. Widmer Engineering Company, 263 Southwestern Reporter, 500). The Court sustained an award of damages on a theory that there was negligence in failing to use timbers or other appliances in moving the radiators, instead of moving them by hand; they weighing from 1,200 to 1,800 pounds each. The following is the substance of the general rules laid down in the opinion:

An employer is not bound to use the newest and best appliances. He discharges his legal duty when he furnishes those ordinarily used and reasonably safe. The question whether or not appliances of a certain kind are reasonably safe is measured by the usages, habits and ordinary risks of the business.

The employer must use reasonable care and precaution to furnish his employees safe appliances with which to do their work.

An employee does not assume risks of injury from unsafe methods adopted by his employer unless such methods are so obviously defective that reasonably prudent men would not attempt to use them.

The test of an employer's responsibility is not whether there is a better or less dangerous way of doing the work than has been adopted by him, but whether the way adopted was reasonably safe. The greater the hazard to the employee, the greater must be the precautions adopted by the employer.

Right to Retain Money to Cover Contingent Liability

In the case of Union Paving Company vs. City of Philadelphia, 82 Pennsylvania Superior Court Reports, 577, it appeared that plaintiff, as contractor with the defendant city, expressly agreed to indemnify the city against liability for damages, loss or injury to person or property, received or sustained from the contractor, its agents or servants, in the performance of the contract work. It was further agreed that the city might retain all or so much of the moneys due the contractor as the director of public works might consider necessary, until all suits on account of such damages, etc., should have been settled.

One Seth sued the city for $1,500 for injuries claimed to have been sustained through falling into a sewer opening charged to have been left negligently uncovered. Plaintiff had installed a sewer inlet at the place in question. The city retained $1,500 on completion of the contract, to indemnify it against possible liability, and, before that suit was determined, plaintiff sued to recover the $1,500 under its contract. Upholding the right of the city to retain the fund, the Court said:

"The evidence in the case was sufficient to link up the accident or injury with the work plaintiff was performing under said contract. It was not necessary for the city, in the present action, to prove that this plaintiff was guilty of the negligence charged by Seth. If a claim for damages for personal injuries, growing out of the plaintiff's performance of its contract, is presented to the city, or suit is brought against the city based thereon, the city is not bound to determine, at its peril, whether or not the plaintiff was negligent in the performance of its contract; it may leave determination of that question to the jury called to pass upon it at the proper time. Its interest is to protect itself, and the contract expressly provides how this may be done—by retaining a sufficient amount from the contract price to save itself harmless until the action" brought by Seth "is decided and it is determined whether the claim is well founded or not.

"Nor is it material that the contractor's bond may also furnish security against Seth's claim. The city may protect itself in more than one way and is not obliged to elect which method it will pursue. The remedies are concurrent."

How Does Weather Affect Construction?

A Study Showing the Number of Days the Temperature Dropped Below Freezing-Point and How Many Days Rain or Snow Interfered with Construction Activities

A PARTICULARLY helpful study has been prepared by the United States Department of Commerce for contractors and others interested in winter construction. This report includes tables of climatic conditions in nine construction centers, with text prepared under the direction of Dr. John M. Gries, Chief of the Division of Building and Housing, by George N. Thompson. In the introduction it is stated that the study was prompted by the great amount of attention that has been directed toward lengthening the building season and by the realization of the fact that very little information on weather conditions is available in suitable form for those interested. The following article is quoted from the body of this valuable report:

In this particular study it was believed that weather tables showing average and extreme conditions over a sufficiently long period—ten years was used—would make a good basis upon which architects and contractors could figure probable delays due to bad weather. Thus, knowing the average, worst and best conditions, they would feel more disposed to attempt all-year construction. These tables are, then, part of a movement to supply scientific aids for builders who choose to challenge the seasons. It is hoped that they will serve as a guide for the compilation of weather tables in each community. With the advance in methods and equipment which more extensive attention to all-year construction is expected to bring, it is believed that the number of days on which construction is now stopped will be materially reduced.

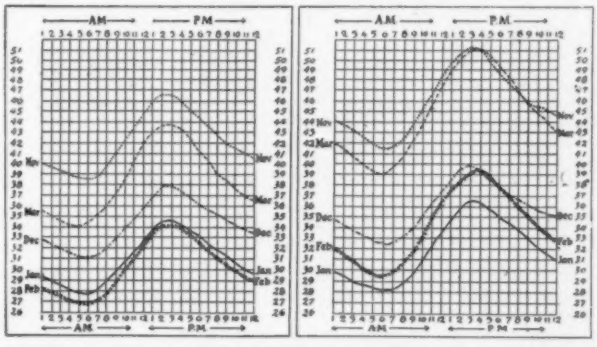


CHART 1. LEFT—MEAN MONTHLY TEMPERATURE BY HOURS IN NEW YORK CITY. RIGHT—MEAN MONTHLY TEMPERATURE BY HOURS IN ST. LOUIS

Construction Problems

Out-door building operations are adversely affected by cold, precipitation in the form of rain, sleet or snow, and high winds. For brief summer periods, heat also is a factor. Such operations are so diversified, however, that the extent to which they are affected differs widely. The problems encountered in the construction of a small home are obviously different from those in erecting a fourteen-story office building. The effects of weather fall naturally into two classes—effects on the human element, and effects on the materials used.

Some cold days merely add a tang to the air that makes workmen act with increased zest; others bring about numbed fingers, lowered vitality, and general decreased efficiency. Rain may be of slight consequence or may so contribute to the discomfort of workmen that they are obliged to quit altogether. High winds may render certain types of work hazardous. Varying effects of weather bear more heavily on some trades than others. Structural steel work is seldom stopped by cold alone. Bricklayers and other mason labor can work except when rain or snow is falling or when the temperature is well below freezing. Plasterers and lathers, the major part of whose work is done indoors, need not be hampered if the materials that they use are properly protected.

Cold of sufficient intensity to freeze concrete may ruin work which has taken much labor and expense to perform. Freezing weather may convert easily handled soil into a stubborn crust. Rain may flood excavations, mire trucks, warp wooden concrete forms, and make painting or roofing impossible.

The above are what might be termed the negative features of winter construction. There are positive ways of overcoming them. Power shovels have shown their ability to conquer frozen ground. Pumps can keep excavations dry and, up to a certain point, raincoats and rubber boots can render work by laborers in the rain endurable. The use of tarpaulins to enclose concrete or masonry, of salamanders to keep it warm, and the heating of concrete aggregates, are simple and effective measures of overcoming danger of freezing and of making workmen comfortable.

Owners who have authorized contractors to go ahead with such precautions have done so with the realization that there are distinct advantages to be gained. Land lying idle and partially completed construction held up during the winter months, mean expenses for interest on the investment and for accrued taxes. Carrying on work without delays results in a revenue-producing building just so much earlier, thereby shortening this non-productive period. Contractors can arrange for orderly delivery of needed materials. Their organizations, built up at much expense, can

TABLE I—COMPARATIVE WEATHER CONDITIONS FOR NINE CITIES

All figures are 10-year averages expressed in days.
(Computation by division of building and housing, Department of Commerce, from United States Weather Bureau records.)

City	Number of working days on which work was probably stopped by precipitation (1): April 1 to Oct. 31	Nov. 1 to March 31: Occurring on warm days	Nov. 1 to March 31: Occurring on freezing days	Nov. 1 to March 31: Total days per year	Number of working days, November to March, on which temperature fell below 32° F. between 7 a. m. and 6 p. m.: Class I (2)	Class II (3)	Class III (4)	Total Classes, I, II and III. (5)	Total cold or rainy working days, Nov. 1, to Mar. 31
St. Paul, Minn.	2.45	0.50	0.00	2.95	53.6	19.5	27.4	105.9	106.40
Denver, Colo.	1.90	0.20	0.25	2.65	24.7	21.3	37.1	83.6	83.80
Chicago, Ill.	4.60	2.05	0.85	7.50	24.2	16.6	31.4	72.2	74.25
Boston, Mass.	6.30	2.70	3.60	12.60	20.2	19.7	31.7	71.7	74.40
New York, N. Y.	5.60	3.60	3.90	13.10	14.3	16.2	33.4	63.9	67.50
St. Louis, Mo.	5.75	3.50	1.85	11.10	14.9	12.0	29.3	56.2	59.70
Atlanta, Ga.	6.60	5.10	0.15	11.85	1.7	4.9	15.4	22.0	27.10
New Orleans, La.	4.95	4.70	0.00	9.65	0.0	0.2	1.7	1.9	6.60
San Francisco, Calif.	1.30	5.30	0.00	6.50	0.0	0.0	0.0	0.0	5.30

(1) Precipitation: Rain, snow, or sleet of .05 inch and more per hour (water content).
(2) Class I (colder days): Days on which temperature fell below 18° at some time, or did not rise above 24° at any time.
(3) Class II (medium days): Lowest not below 18°, but temperature reached or exceeded 25° during the day.
(4) Class III (warmer days): Lowest between 25° and 32°.
(5) Total cold or rainy working days: November 1 to March 31. Sum of days in column 2 and column 8. The term "working days" includes all except Sundays and holidays.

be held intact, and their employees will appreciate the chance for steady work at what is usually the dull season.

The Effect of Temperature Drop

Enough has been said to demonstrate that the problems confronting builders are complex. In view of the varying effects of different degrees of cold upon men and materials, the first step in the preparation of these weather tables was the establishing of three classes of days on which the temperature went below the freezing-point at some time between 7 A. M. and 6 P. M., as the freezing-point is the critical temperature at which widely used building materials are subject to injury. The hours named were chosen because they included the customary working hours and because investigation showed that mean minimum temperatures for winter days are very close to those occurring at 7 A. M. This is well brought out in Chart I, which is based on mean temperatures covering a period of more than fifty years.

The three classes of cold days were designated Class I, Class II, and Class III, and were arranged as follows: to Class I were assigned all those days on which the temperature went below 18° at some time or did not rise above 24° at any time; to Class II were assigned all days on which the temperature did not go below 18° and exceeded 25° at some time; to Class III were assigned the comparatively mild days whose lowest temperature was between 25° and 32°.

On the Class I days there is generally a pronounced slowing up of outdoor activity. Less progressive builders are apt to suspend concrete and masonry work, while those having more advanced methods need to use a maximum degree of protection for men and materials. On Class II days, a much better chance of continuous work is afforded, but workmen may suffer, especially if exposed to high winds, and vigilance in the protection of materials against freezing is necessary. On Class III days, interference with the human factor is greatly lessened, but some materials, such as concrete in thin forms, are still endangered.

TABLE II—NUMBER OF WORKING DAYS, NOVEMBER TO MARCH, ON WHICH TEMPERATURE FELL BELOW 32° F. BETWEEN 7 A. M. AND 6 P. M.

Years	St. Paul, Minnesota: Class I days	Class II days	Class III days	Total cold days	Denver, Colorado: Class I days	Class II days	Class III days	Total cold days
1913–1914	43.0	23.0	34.0	100.0	21.0	26.0	38.0	85.0
1914–1915	56.0	28.0	23.0	107.0	24.0	24.0	39.0	87.0
1915–1916	67.0	18.0	21.0	106.0	31.0	20.0	30.0	81.0
1916–1917	72.0	14.0	27.0	115.0	34.0	16.0	43.0	93.0
1917–1918	83.0	9.0	27.0	99.0	29.0	9.0	26.0	64.0
1918–1919	54.0	28.0	18.0	100.0	22.0	26.0	40.0	88.0
1919–1920	77.0	17.0	19.0	113.0	31.0	24.0	39.0	94.0
1920–1921	43.0	22.0	33.0	98.0	17.0	25.0	35.0	77.0
1921–1922	59.0	22.0	32.0	113.0	28.0	20.0	23.0	71.0
1922–1923	72.0	16.0	30.0	118.0	20.0	18.0	52.0	90.0
Average	58.6	19.9	27.4	105.9	24.7	21.3	37.1	83.6

Years	Chicago, Illinois: Class I days	Class II days	Class III days	Total cold days	Boston, Massachusetts: Class I days	Class II days	Class III days	Total cold days
1913–1914	16.0	15.0	32.0	63.0	18.0	17.0	33.0	68.0
1914–1915	24.0	18.0	35.0	77.0	12.0	20.0	42.0	74.0
1915–1916	21.0	28.0	30.0	79.0	20.0	25.0	29.0	74.0
1916–1917	39.0	16.0	26.0	81.0	16.0	29.0	25.0	70.0
1917–1918	44.0	10.0	19.0	73.0	36.0	21.0	30.0	87.0
1918–1919	13.0	8.0	32.0	53.0	8.0	17.0	34.0	59.0
1919–1920	36.0	20.0	21.0	77.0	22.0	18.0	32.0	72.0
1920–1921	9.0	13.0	37.0	59.0	9.0	15.0	29.0	53.0
1921–1922	19.0	20.0	30.0	69.0	17.0	18.0	34.0	69.0
1922–1923	31.0	18.0	42.0	91.0	35.0	17.0	29.0	64.0
Average	24.2	16.6	31.4	72.2	20.3	19.7	31.7	71.7

Years	New York, New York: Class I days	Class II days	Class III days	Total cold days	St. Louis, Missouri: Class I days	Class II days	Class III days	Total cold days
1913–1914	17.0	14.0	32.0	63.0	11.0	13.0	32.0	56.0
1914–1915	7.0	18.0	42.0	67.0	16.0	10.0	39.0	65.0
1915–1916	17.0	14.0	42.0	77.0	14.0	12.0	41.0	67.0
1916–1917	13.0	21.0	28.0	62.0	19.0	18.0	27.0	64.0
1917–1918	26.0	25.0	25.0	76.0	37.0	6.0	16.0	59.0
1918–1919	4.0	9.0	32.0	45.0	9.0	8.0	21.0	38.0
1919–1920	22.0	17.0	40.0	80.0	18.0	16.0	30.0	64.0
1920–1921	7.0	6.0	29.0	42.0	6.0	10.0	32.0	38.0
1921–1922	12.0	13.0	27.0	52.0	11.0	16.0	32.0	59.0
1922–1923	17.0	21.0	27.0	65.0	8.0	11.0	33.0	52.0
Average	14.3	16.2	33.4	63.9	14.9	12.0	29.3	56.2

Years	Atlanta, Georgia: Class I days	Class II days	Class III days	Total cold days	New Orleans, Louisiana: Class I days	Class II days	Class III days	Total cold days
1913–1914	1.0	3.0	20.0	24.0	0.0	0.0	1.0	1.0
1914–1915	2.0	4.0	19.0	25.0	0.0	0.0	3.0	3.0
1915–1916	1.0	7.0	13.0	21.0	0.0	0.0	1.0	1.0
1916–1917	4.0	5.0	17.0	26.0	0.0	0.0	5.0	5.0
1917–1918	4.0	12.0	24.0	40.0	0.0	1.0	4.0	5.0
1918–1919	1.0	3.0	9.0	13.0	0.0	1.0	1.0	2.0
1919–1920	4.0	7.0	12.0	23.0	0.0	0.0	1.0	1.0
1920–1921	0.0	1.0	13.0	14.0	0.0	0.0	1.0	1.0
1921–1922	0.0	3.0	11.0	14.0	0.0	0.0	0.0	0.0
1922–1923	0.0	4.0	16.0	20.0	0.0	0.0	0.0	0.0
Average	1.7	4.9	15.4	22.0	0.0	0.2	1.7	1.9

Note: The text below refers to Table II above.

(Computation by division of building and housing, Department of Commerce, from United States Weather Bureau records.)

In San Francisco for the 10-year period there were no days on which the temperature went below freezing during the hours 7 a. m. to 6 p. m.

Class I (colder days): Days on which temperature fell below 18° at some time, or did not rise above 24° at any time.

Class II (medium days): Lowest not below 18°, but temperature reached or exceeded 25° during the day.

Class III (warmer days): Lowest between 25° and 32°.

When Does Rain or Snow Interfere with Work?

It was a more difficult matter to fix the point at which precipitation would interfere with work. As already noted, a slight rain, not enough to pre-

vent men from working, would make outdoor painting inadvisable. It was finally determined to take the amount of precipitation which would force workmen to quit through personal discomfort as the critical point for use in these tables. After consultation with Weather Bureau officials and experienced builders, this point was defined as .05 inches of rain per hour per square foot, or its water equivalent in snow or sleet. What this amount of rain means may perhaps be best shown by the quantity of water which it would deposit on a building of a given roof area, say 75 feet by 100 feet. In one hour this quantity would be about 4.9 barrels of 45 gallons each.

Nine cities were chosen for this study. They were Atlanta, Boston, Chicago, Denver, New Orleans, New York, San Francisco, St. Louis and St. Paul. These gave a good geographical distribution, and the conditions found are probably representative of the regions in which they are located. The period of November to March inclusive was selected as the one for collecting temperature records, as freezing days outside that period are comparatively few. Through the United States Weather Bureau, daily records of temperature for each hour from 7 A. M. to 6 P. M. over ten years were then obtained. Such records are kept in every city where the Weather Bureau has a station and are recorded upon its Form 1030. As the primary object was to determine the number of working days lost because of bad weather, the next step was to cross off the records all Sundays and the holidays commonly observed in each of the cities. Inspection of the record sheets for temperature variations was then made, and a tabulation of Class I, II and III days in each month was drawn up. Averages were computed and the results arranged in convenient form.

Precipitation records for the same hours were also obtained for the ten-year period, but in this case the figures were obtained for the entire year instead of from November to March. They were inspected for the occurrence of the critical amount of precipitation, as previously described, tabulations made, and the records checked back to determine on what class of cold days, if any, the precipitation occurred. Ten-year monthly averages were then arrived at, as in the case of cold days.

While the identification of Class I, II, and III days was readily made, some discretion had to be exercised in determining for what part of a day a given amount of precipitation would stop work. For instance, when a brief but heavy shower was indicated, it was assumed that workmen would remain at the job and that work would be resumed. When there was a heavy shower in the morning and continued lighter precipitation during the day, it was assumed that that day would be lost.

TABLE III—RECORDS OF PRECIPITATION IN NINE CITIES 1913-1923

Years.	St. Paul, Minn.*	Denver, Colo.*	Chicago, Ill.*	Boston, Mass.*	New York, N. Y.†	St. Louis, Mo.*	Atlanta, Ga.*	New Orleans, La.*	San Francisco, Cal.*
1913-1914	4.0	6.5	6.5	8.5	10.5	13.5	8.5	7.5	8.5
1914-1915	8.0	5.0	6.0	13.0	14.0	12.0	12.0	11.5	8.0
1915-1916	4.5	0.5	9.5	11.5	15.0	16.0	9.5	8.0	10.0
1916-1917	2.5	2.0	5.5	12.5	19.0	5.5	12.5	6.5	4.0
1917-1918	4.5	2.5	8.5	10.5	11.0	11.0	12.5	7.5	5.0
1918-1919	4.0	0.0	8.0	8.0	12.0	16.5	14.5	15.0	5.5
1919-1920	2.5	2.5	7.5	21.0	16.5	9.5	12.0	10.0	3.5
1920-1921	3.5	2.0	6.5	11.5	10.0	9.0	10.0	5.0	5.0
1921-1922	2.0	0.0	10.0	16.5	14.0	6.0	16.0	10.5	5.5
1922-1923	5.0	5.5	7.0	13.0	7.5	13.0	10.5	15.0	8.5
Average	4.0	2.7	7.5	12.6	12.1	11.1	11.9	9.7	6.5

Note: The text below refers to Table III above.

(Number of working days on which precipitation interfered with work during working hours.)
(Computation by division of building and housing, Department of Commerce, United States Weather Bureau records.)

Precipitation: Rain, snow, or sleet of .05 inches and more per hour (water content).

*November 1 to October 31.
†October 1 to September 30.

TABLE IV—MONTHLY MEAN MINIMUM AND MAXIMUM TEMPERATURES FOR TEN CITIES

(All figures are expressed in degrees Fahrenheit.)

City.	November. Min.	November. Max.	December. Min.	December. Max.	January. Min.	January. Max.	February. Min.	February. Max.	March. Min.	March. Max.
St. Paul	27.2	37.0	15.6	23.0	7.1	16.9	9.9	21.6	22.8	35.2
Denver	31.8	50.2	26.3	49.8	23.8	39.8	25.2	42.0	31.2	50.0
Chicago	36.4	43.7	24.6	32.2	21.2	28.0	22.0	29.8	31.9	39.6
Boston	38.1	47.1	28.8	34.1	23.9	32.7	24.0	33.1	31.5	41.0
New York, N. Y.	38.42	46.62	30.98	37.73	27.65	34.45	26.75	34.25	34.18	42.62
St. Louis	41.4	51.0	32.4	39.8	28.3	36.5	29.5	39.3	38.9	50.5
Atlanta	46.3	58.7	39.5	50.1	38.9	48.1	39.8	50.6	46.5	59.1
Portland	42.5	51.1	35.7	45.2	36.6	42.8	39.0	46.3	41.3	54.1
New Orleans	57.5	66.8	51.7	60.3	51.6	60.6	53.7	63.3	59.1	70.3
San Francisco	53.0	61.0	48.5	54.5	46.9	53.9	49.2	56.4	50.2	58.2

Note: The text below refers to Table IV above.

(Computation by division of building and housing, Department of Commerce, United States Weather Bureau records.)

Note: A tenth city, Portland, Oregon, has been added in this table, as information regarding it was available.

TABLE V—MEAN MONTHLY TEMPERATURES BY HOURS, NEW YORK

Month.	1 a.m.	2 a.m.	3 a.m.	4 a.m.	5 a.m.	6 a.m.	7 a.m.	8 a.m.	9 a.m.	10 a.m.	11 a.m.	Noon.
Nov.	40.2	39.6	39.2	38.8	38.5	38.4	38.5	39.6	40.7	42.2	43.6	44.8
Dec.	32.9	32.4	32.0	31.6	31.1	31.1	31.0	32.0	32.9	33.9	35.0	36.1
Jan.	29.3	28.9	28.5	28.1	27.7	27.7	27.9	28.7	29.5	30.5	31.5	32.7
Feb.	28.3	27.8	27.6	27.2	26.8	26.8	26.9	27.9	29.0	30.1	31.3	32.3
Mar.	38.5	38.0	37.6	37.2	34.2	34.2	34.8	36.6	37.3	38.7	40.4	42.4

Month.	1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.	8 p.m.	9 p.m.	10 p.m.	11 p.m.	Mid-night.
Nov.	45.9	46.6	46.6	46.0	45.1	44.5	43.4	42.7	42.0	41.6	41.0	40.6
Dec.	37.1	37.7	37.8	37.3	36.6	36.0	35.4	34.9	34.5	34.1	33.7	33.2
Jan.	33.7	34.3	34.5	34.1	33.5	32.9	32.2	31.7	31.1	30.5	30.0	29.7
Feb.	33.3	34.1	34.3	33.9	33.3	32.6	31.8	31.0	30.3	29.7	29.4	28.9
Mar.	42.9	43.5	43.7	43.4	42.7	41.0	40.2	39.1	38.2	37.5	36.7	36.5

Note: The text below refers to Table V above.

(Computation by division of building and housing, Department of Commerce, United States Weather Bureau records.)

Average mean monthly temperature: November, 42.1; December, 34.2, January, 30.8; February, 30.2; March, 38.4.

TABLE VI—MEAN MONTHLY TEMPERATURES BY HOURS, ST. LOUIS

Month.	1 a.m.	2 a.m.	3 a.m.	4 a.m.	5 a.m.	6 a.m.	7 a.m.	8 a.m.	9 a.m.	10 a.m.	11 a.m.	Noon.
Nov.	44.0	43.6	43.0	42.4	41.8	41.4	41.6	43.5	45.2	46.8	46.8	48.2
Dec.	34.8	34.2	33.8	33.4	32.9	32.4	32.6	33.2	33.9	35.0	36.0	37.2
Jan.	29.9	29.5	29.9	28.7	28.5	28.3	28.3	28.9	29.7	30.9	32.3	33.5
Feb.	32.3	31.7	30.9	30.3	29.7	29.5	30.1	30.7	31.7	32.9	34.7	36.3
Mar.	42.1	41.6	40.7	39.9	39.3	38.9	39.9	40.9	42.3	44.0	45.9	47.5

Month.	1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.	8 p.m.	9 p.m.	10 p.m.	11 p.m.	Mid-night.
Nov.	49.4	50.6	51.0	50.4	49.4	48.2	47.4	46.6	46.4	45.2	44.8	44.4
Dec.	39.4	39.4	39.5	39.2	38.4	37.7	37.1	36.6	36.1	35.5	35.2	34.8
Jan.	34.7	35.3	36.5	36.2	35.7	34.9	34.3	33.5	32.9	32.1	31.5	30.9
Feb.	37.7	38.5	39.1	39.3	38.7	37.7	36.9	35.9	34.9	34.1	33.3	32.7
Mar.	48.9	49.9	50.9	50.5	49.9	48.9	47.9	46.5	45.5	44.7	43.9	43.9

Note: The text below refers to Table VI above.

(Computation by division of building and housing, Department of Commerce, United States Weather Bureau records.)

Average mean monthly temperature: November, 45.7; December, 35.7; January, 31.5; February, 34.2; March, 44.7.

St. Paul Leads in Number of Cold Days

An analysis of the tables discloses that St. Paul leads in number of Class I days, as might be expected from its northerly location. The average yearly number of such days is 58.6. Denver follows with 24.7, then Chicago with 24.2, Boston with 20.3, St. Louis with 14.9, New York with 14.3, Atlanta with 1.7. New Orleans and San Fran-

cisco have none. A noteworthy fact is that St. Louis leads New York in this severe weather by a small margin.

When the cities are grouped according to number of Class II days, St. Paul yields first place to Denver, which has 21.8. St. Paul has 19.9, Boston 19.7, Chicago 16.6, New York 16.2, St. Louis 12.0, Atlanta 4.9, New Orleans 0.2, and San Francisco none.

Denver also has the greatest number of Class III days—37.1. Then comes New York with 33.4, Boston with 31.7, Chicago with 31.4, St. Louis with 29.3, St. Paul with 27.4, Atlanta with 15.4, New Orleans with 1.7, and San Francisco with none.

Totals of all three classes for each city place St. Paul in the lead with 105.9 freezing days. The maximum in any given year of the ten-year period was 115 in 1916-17, and the minimum was 98 in 1920-21.

Denver has the next highest average number of freezing days—83.6; the maximum was 97 in 1914-15, and the minimum 64 in 1917-18.

Chicago had an average of 72.2, with a maximum of 87 in 1919-20 and a minimum of 53 in the winter before.

Boston had an average of 71.7, with a maximum of 87 in 1917-18 and a minimum of 53 in 1920-21.

New York had an average of 63.9, with a maximum of 80 in 1919-20 and a minimum of 42 in 1920-21.

St. Louis had an average of 56.2, with a maximum of 67 in 1915-16 and a minimum of 38 in 1918-19 and 1920-21.

Atlanta had an average of 22, with a maximum of 40 in 1917-18 and a minimum of 13 in 1918-19.

New Orleans had an average of 1.9, with a maximum of 5 in 1916-17 and 1917-18, and none in two winters of the ten.

San Francisco had none.

New York Is the Wettest

New York had an average of 13.1 days per year on which work would probably have been stopped by precipitation. A wide range between years was shown, with a maximum of 19.0 days in 1916-17 and a minimum of 7.5 in 1922-23.

Boston had an average of 12.6 days, with a maximum of 21.0 in the year 1919-1820 and a minimum of 8.0 in 1918-1919.

In Atlanta the average was 11.9 days, with 16.0 in 1921-22 and 8.5 in 1913-14 as the high and low points.

New Orleans averaged 9.7 days, with a maximum of 15.0 in 1918-1919 and 1922-1923, and a minimum of 5.0 in 1920-21.

In Chicago the average was 7.5 days, the maximum was 10.0 in 1921-22 and the minimum 5.5 in 1916-17.

In San Francisco the average was 6.5 days, with 10.0 as the maximum in 1915-1916 and 3.5 as the minimum in 1919-20.

In St. Paul the average was 4.0 days, with 6.0 as the maximum in 1914-15 and 2.5 the minimum in 1916-17 and 1919-20.

In Denver the average was 2.7, with 6.5 the maximum in 1913-14 and none in 1918-19.

Thus St. Paul and Denver, which had the greatest number of freezing days, had the least hindrance from precipitation.

The determination of the total of freezing days and days of precipitation is readily arrived at by consulting the tables. On some days, of course, both freezing weather and precipitation occurred. Taking the St. Louis table, (XIV), as an example, it will be seen that the number of freezing days, excluding those on which precipitation occurred, was 14.5 plus 11.6 plus 28.2, or 54.3. Adding to this the total number of days of precipitation, or 11.1, gives 65.4 as the average number of days on which freezing or precipitation occurred.

Value of the Study

An example of a building situation in which the weather tables may be put to use is given below.

A prominent public utility organization in the vicinity of Chicago has outgrown its quarters, and officials have discussed the possibilities of erecting a building for its exclusive use. Representatives of another concern approach the officers in the late spring with a very advantageous offer for the balance of the lease, which has some time to run. There is a stipulation that occupancy must be given by the following April. The officers make inquiries and learn that it is entirely possible to erect a suitable building through the coming winter and have it ready on time, provided a decision is reached promptly. Moreover, experienced architects assure them that there are other advantages to the arrangement besides the profitable disposal of the lease. Labor is less actively employed during the winter, and a better choice of skilled workmen is to be had. Materials can be obtained without the long delays resulting from congested transportation facilities in the peak period of construction. Other advantages are enumerated which bring about a favorable decision. Plans for a three-story brick and terra cotta trim building expected to cost about $300,000 are prepared and bids called for.

TABLE VII—WEATHER CONDITIONS AFFECTING OUTDOOR CONSTRUCTION ATLANTA, GEORGIA, 1913-1923

Average number of working days in each month on which there was precipitation* or freezing weather during working hours.
(Computation by division of building and housing, Department of Commerce, from United States Weather Bureau records.)

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
Class I: (1)													
Total number of days	...	...	...	...	0.1	0.3	0.5	0.6	0.2	...	...	...	1.7
Number of days on which there was precipitation	...	...	...	...	0.0	0.0	0.0	0.0	0.0	...	...	...	0.0
Number of days excluding days of precipitation	...	...	...	...	0.1	0.3	0.5	0.6	0.2	...	...	...	1.7
Class II: (2)													
Total number of days	...	...	...	...	0.1	1.3	1.5	1.4	0.6	...	...	...	4.9
Number of days on which there was precipitation	...	...	...	...	0.0	0.0	0.0	0.0	0.0	...	...	...	0.0
Number of days excluding days of precipitation	...	...	...	...	0.1	1.3	1.5	1.4	0.6	...	...	...	4.9
Class III: (3)													
Total number of days	...	...	...	...	1.4	3.5	4.8	3.8	1.9	...	...	...	15.4
Number of days on which there was precipitation	...	...	...	...	0.0	0.0	0.2	0.0	0.0	...	...	...	0.2
Number of days excluding days of precipitation	...	...	...	...	1.4	3.5	4.6	3.8	1.9	...	...	...	15.2
Precipitation:*													
Total number of days	0.8	1.1	0.5	1.1	0.5	1.2	1.5	0.9	1.2	1.0	1.3	0.8	11.9
Number of days in Classes I, II and III	...	...	...	...	0.0	0.0	0.2	0.0	0.0	...	...	...	0.2
Number of days not in Classes I, II and III	0.8	1.1	0.5	1.1	0.5	1.2	1.3	0.9	1.2	1.0	1.3	0.8	11.7

*Precipitation—Rain, snow or sleet of .05 inch and more per hour. (Water content.)
(1) Class I (colder days)—Days on which temperature fell be low 18° at some time, or did not rise above 24° at any time.
(2) Class II (medium days)—Lowest not below 18°, but temper ature reached or exceeded 25° during the day.
(3) Class III (warmer days)—Lowest between 25° and 25°.
Of 11.9 average total number of days of precipitation, 0.2 days occurred during cold weather.

TABLE VIII — WEATHER CONDITIONS AFFECTING OUTDOOR CONSTRUCTION BOSTON, MASSACHUSETTS, 1913-1923

Average number of working days in each month on which there was precipitation* or freezing weather during working hours. (Computation by division of building and housing, Department of Commerce, from United States Weather Bureau records.)

Class I: (1)	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
Total number of days	...	...	...	...	0.1	4.0	7.7	6.7	1.8	...	...	...	20.3
Number of days on which there was precipitation	...	...	...	...	0.0	0.0	0.0	0.1	0.1	...	...	...	0.2
Number of days excluding days of precipitation	...	...	...	...	0.1	4.0	7.7	6.6	1.7	...	...	...	20.1
Class II: (2)													
Total number of days	...	...	...	...	0.8	4.3	4.8	5.4	4.4	...	...	...	19.7
Number of days on which there was precipitation	...	...	...	...	0.0	0.2	0.2	0.3	0.2	...	...	...	.9
Number of days excluding days of precipitation	...	...	...	...	0.8	4.1	4.6	5.1	4.2	...	...	...	18.8
Class III: (3)													
Total number of days	...	...	...	...	2.8	8.1	6.7	6.8	6.3	...	...	...	31.7
Number of days on which there was precipitation	...	...	...	...	0.1	0.4	0.7	0.8	0.5	...	...	...	2.5
Number of days excluding days of precipitation	...	...	...	...	2.7	7.7	6.0	6.0	5.8	...	...	...	29.2
Precipitation:*													
Total number of days	0.7	0.8	0.7	0.8	0.9	1.3	1.1	1.5	1.5	1.3	1.2	0.8	12.6
Number of days in Classes I, II and III	...	...	...	...	0.1	0.6	0.9	1.2	0.8	...	...	...	3.6
Number of days not in Classes I, II and III	0.7	0.8	0.7	0.8	0.8	0.7	0.2	0.3	0.7	1.3	1.2	0.8	9.0

Of 12.6 average total number of days of precipitation, 3.6 days occurred during cold weather.

TABLE IX—WEATHER CONDITIONS AFFECTING OUTDOOR CONSTRUCTION CHICAGO, ILLINOIS, 1913-1923

Average number of working days in each month on which there was precipitation* or freezing weather during working hours. (Computation by division of building and housing, Department of Commerce, from United States Weather Bureau records.)

Class I. (1)	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total
Total number of days	...	...	...	...	0.5	6.7	8.9	6.7	1.4	...	...	...	24.2
Number of days on which there was precipitation	...	...	...	...	0.0	0.1	0.1	0.1	0.0	...	...	...	0.3
Number of days excluding days of precipitation	...	...	...	...	0.5	6.6	8.8	6.6	1.4	...	...	...	23.9
Class II: (2)													
Total number of days	...	...	...	...	1.4	3.0	4.6	4.8	2.8	...	...	...	16.6
Number of days on which there was precipitation	...	...	...	...	0.0	0.0	0.1	0.0	0.0	...	...	...	0.1
Number of days excluding days of precipitation	...	...	...	...	1.4	3.0	4.5	4.8	2.8	...	...	...	16.5
Class III: (3)													
Total number of days	...	...	...	...	4.1	6.1	6.0	7.0	8.2	...	...	...	31.4
Number of days on which there was precipitation	...	...	...	...	0.1	0.1	0.0	0.2	0.1	...	...	...	0.5
Number of days excluding days of precipitation	...	...	...	...	4.0	6.0	6.0	6.8	8.1	...	...	...	30.9
Precipitation:*													
Total number of days	0.5	0.4	0.3	0.3	0.5	0.6	0.3	0.5	1.0	0.6	1.0	0.5	7.5
Number of days in Classes I, II and III	...	...	...	...	0.1	0.2	0.2	0.3	0.1	0.0	0.0	0.0	0.9
Number of days not in Classes I, II and III	0.5	0.4	0.3	0.3	0.4	0.4	0.1	0.2	0.9	0.6	1.0	0.5	6.6

Of 7.5 average total number of days of precipitation, .9 days occurred during cold weather.

TABLE X—WEATHER CONDITIONS AFFECTING OUTDOOR CONSTRUCTION DENVER, COLORADO, 1913-1923

Average number of working days in each month on which there was precipitation* or freezing weather during working hours. (Computation by division of building and housing, Department of Commerce, from United States Weather Bureau records.)

Class I: (1)	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
Total number of days	...	...	...	...	2.1	7.9	7.0	5.4	2.3	...	...	...	24.7
Number of days on which there was precipitation	...	...	...	...	0.0	0.2	0.0	0.0	0.1	...	...	...	0.3
Number of days excluding days of precipitation	...	...	...	...	2.1	7.7	7.0	5.4	2.2	...	...	...	24.4
Class II: (2)													
Total number of days	...	...	...	...	2.2	5.2	5.6	5.1	3.7	...	...	...	21.8
Number of days on which there was precipitation	...	...	...	...	0.0	0.1	0.0	0.0	0.0	...	...	...	0.2
Number of days excluding days of precipitation	...	...	...	...	2.2	5.1	5.6	5.0	3.7	...	...	...	21.6
Class III: (3)													
Total number of days	...	...	...	...	7.7	5.9	6.9	8.1	8.5	...	...	...	37.1
Number of days on which there was precipitation	...	...	...	...	0.1	0.1	0.0	0.0	0.0	...	...	...	0.2
Number of days excluding days of precipitation	...	...	...	...	7.6	5.8	6.9	8.1	8.5	...	...	...	36.9
Precipitation:*													
Total number of days	0.0	0.2	0.2	0.4	0.2	0.3	0.0	0.1	0.2	0.5	0.3	0.3	2.7
Number of days in Classes I, II and III	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.1	0.1	0.0	0.0	0.0	0.6
Number of days not in Classes I, II and III	0.0	0.2	0.2	0.4	0.1	0.0	0.0	0.0	0.1	0.5	0.3	0.3	2.1

Of 2.7 average total number of days of precipitation, .6 days occurred during cold weather.

TABLE XI—WEATHER CONDITIONS AFFECTING OUTDOOR CONSTRUCTION NEW ORLEANS, LOUISIANA, 1913-1923

Average number of working days in each month on which there was precipitation* or freezing weather during working hours. (Computation by division of building and housing, Department of Commerce, from United States Weather Bureau records.)

Class I: (1)	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total
Total number of days	...	...	...	...	0.0	0.0	0.0	0.0	0.0	...	...	...	0.0
Number of days on which there was precipitation	...	...	...	...	0.0	0.0	0.0	0.0	0.0	...	...	...	0.0
Number of days excluding days of precipitation	...	...	...	...	0.0	0.0	0.0	0.0	0.0	...	...	...	0.0
Class II: (2)													
Total number of days	...	...	...	...	0.0	0.0	0.2	0.0	0.0	...	...	...	0.2
Number of days on which there was precipitation	...	...	...	...	0.0	0.0	0.0	0.0	0.0	...	...	...	0.0
Number of days excluding days of precipitation	...	...	...	...	0.0	0.0	0.2	0.0	0.0	...	...	...	0.2
Class III: (3)													
Total number of days	...	...	...	...	0.0	0.5	0.6	0.5	0.1	...	...	...	1.7
Number of days on which there was precipitation	...	...	...	...	0.0	0.0	0.0	0.0	0.0	...	...	...	0.0
Number of days excluding days of precipitation	...	...	...	...	0.0	0.5	0.6	0.5	0.1	...	...	...	1.7
Precipitation:*													
Total number of days	1.0	0.9	0.4	0.9	0.8	1.5	0.9	0.7	0.8	0.6	0.6	0.6	9.7
Number of days in Classes I, II and III	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Number of days not in Classes I, II and III	1.0	0.9	0.4	0.9	0.8	1.5	0.9	0.7	0.8	0.6	0.6	0.6	9.7

*Precipitation—Rain, snow, or sleet of .05 inch and more per hour. (Water content.)
(1) Class I (colder days)—Days on which temperature fell below 18° at some time, or did not rise above 24° at any time.
(2) Class II (medium days)—Lowest not below 18°, but temperature reached or exceeded 25° during the day.
(3) Class III (warmer days)—Lowest between 25° and 32°.

The contractor who figures on this building can turn to the Chicago weather table, and find for each month the average number of days on which rain, sleet, snow, or cold is likely to cause trouble. Supposing that he starts operations on September 1, the total of inclement days as shown up to April 1 is 75.8. These include 24.2 Class I days, 16.6 Class II days, and 31.4 Class III days. Precipitation would be a factor on 0.9 days of these and also would make up the difference between their sum and the 75.8 inclement days given up to April 1. This difference amounts to 3.6 days. Knowing from experience and established standards what precautions are necessary for his particular work in each gradation of weather, he has some basis for figuring anticipated delays and expense.

So far as is known, this is the first attempt to work out weather tables applying to construction on anything like this scale. Methods of procedure and arbitrary standards have had to be adopted, which it may seem wise to modify later. It is recognized that actual conditions encountered in a given year are likely to vary to a considerable extent from the averages given. However, the extreme conditions cited should offer a safe guide for those who wish to know the worst that is likely to happen. No tables can take account of the sudden drops in temperatures that are likely to occur at times. The most that is claimed for these tables is that they present in handy form what ten years' experience has shown to be an average

TABLE XII—WEATHER CONDITIONS AFFECTING OUTDOOR CONSTRUCTION
NEW YORK, NEW YORK, 1913-1923

Average number of working days in each month on which there was precipitation* or freezing weather during working hours.
(Computation by division of building and housing, Department of Commerce, from United States Weather Bureau records.)

Class I: (1)	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
Total number of days	...	...	...	0.0	0.0	2.4	5.5	5.0	1.4	0.0	...	...	14.3
Number of days on which there was precipitation	...	...	...	0.0	0.0	0.1	0.2	0.1	0.1	0.0	...	...	0.5
Number of days excluding days of precipitation	...	...	...	0.0	0.0	2.3	5.3	4.9	1.3	0.0	...	...	13.8
Class II: (2)													
Total number of days	...	...	...	0.0	0.2	4.4	4.3	4.3	3.0	0.0	...	....	16.2
Number of days on which there was precipitation	...	...	...	0.0	0.0	0.1	0.0	0.4	0.1	0.0	...	...	0.6
Number of days excluding days of precipitation	...	...	...	0.0	0.2	4.3	4.3	3.9	2.9	0.0	...	...	15.6
Class III: (3)													
Total number of days	...	...	...	0.0	3.4	9.1	7.1	6.5	7.0	0.0	...	...	33.4
Number of days on which there was precipitation	...	...	...	0.0	0.0	1.0	0.4	0.9	0.5	0.0	...	...	2.8
Number of days excluding days of precipitation	...	...	...	0.0	3.4	8.1	6.7	5.9	6.5	0.0	...	...	30.6
Precipitation:*													
Total number of days	0.7	0.6	0.7	0.9	0.6	1.9	1.5	2.2	1.3	1.0	1.0	0.7	13.1
Number of days in Classes I, II and III	0.0	0.0	0.0	0.0	0.0	1.1	0.6	1.5	0.7	0.0	0.0	0.0	2.9
Number of days not in Classes I, II and III	0.7	0.6	0.7	0.9	0.6	0.8	0.9	0.7	0.6	1.0	1.0	0.7	9.2

Of 13.1 average total number of days of precipitation, 3.9 days occurred during cold weather.

*Precipitation—Rain, snow, or sleet of .05 inch and more per hour. (Water content.)
(1) Class I (colder days)—Days on which temperature fell below 18° at some time, or did not rise above 24° at any time.
(2) Class II (medium days)—Lowest not below 18°, but temperature reached or exceeded 25° during the day.
(3) Class III (warmer days)—Lowest between 25° and 32°.

TABLE XIII—WEATHER CONDITIONS AFFECTING OUTDOOR CONSTRUCTION
SAN FRANCISCO, CALIFORNIA, 1913-1923

Average number of working days in each month on which there was precipitation.* No freezing weather was recorded in San Francisco during the hours from 7 a. m. to 6 p. m. in the 10-year period.

(Computation by division of building and housing, Department of Commerce, from United States Weather Bureau records.)

Precipitation:*	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb	Mar.	Apr.	May.	June.	Total.
Total number of days	0.0	0.0	0.3	0.3	0.5	1.3	1.7	0.9	0.6	0.5	0.2	0.0	6.5

*Precipitation—Rain of .05 inch and more per hour.

TABLE XIV—WEATHER CONDITIONS AFFECTING OUTDOOR CONSTRUCTION
ST. LOUIS, MISSOURI, 1913-1923

Average number of working days in each month on which there was precipitation* or freezing weather during working hours.
(Computation by division of building and housing, Department of Commerce, from United States Weather Bureau records.)

Class I: (1)	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
Total number of days	...	...	...	...	0.3	4.0	5.9	4.0	0.7	...	...	...	14.9
Number of days on which there was precipitation	...	...	...	...	0.0	0.0	0.1	0.3	0.0	...	...	...	0.4
Number of days excluding days of precipitation	...	...	...	...	0.3	4.0	5.8	3.7	0.7	...	...	...	14.5
Class II: (2)													
Total number of days	...	...	...	...	0.7	2.1	3.6	3.2	1.2	...	...	...	12.0
Number of days on which there was precipitation	...	...	...	...	0.0	0.0	0.2	0.1	0.1	...	...	...	0.4
Number of days excluding days of precipitation	...	...	...	...	0.7	2.1	3.4	3.2	1.2	...	...	...	11.6
Class III: (3)													
Total number of days	...	...	...	...	2.2	6.9	5.8	7.2	6.1	...	...	...	28.2
Number of days on which there was precipitation	...	...	...	...	0.0	0.1	0.1	0.6	0.3	...	...	...	1.1
Number of days excluding days of precipitation	...	...	...	...	2.2	6.8	5.7	6.6	5.8	...	...	...	27.1
Precipitation:*													
Total number of days	0.5	0.7	0.9	0.8	0.8	1.0	0.9	1.7	1.0	1.2	0.8	0.8	11.1
Number of days in Classes I, II and III	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.5	0.4	0.0	0.0	0.0	1.8
Number of days not in Classes I, II and III	0.5	0.7	0.9	0.8	0.8	0.9	0.5	0.8	0.6	1.2	0.8	0.8	9.3

Of 11.1 average total number of days of precipitation, 1.8 days occurred during cold weather.

TABLE XV—WEATHER CONDITIONS AFFECTING OUTDOOR CONSTRUCTION
ST. PAUL, MINNESOTA, 1913-1923

Average number of working days in each month on which there was precipitation* or freezing weather during working hours.
(Computation by division of building and housing, Department of Commerce, from United States Weather Bureau records.)

Class I: (1)	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
Total number of days	...	...	...	...	3.9	13.0	17.8	16.8	7.1	0.0	...	...	58.6
Number of days on which there was precipitation	...	...	...	...	0.0	0.0	0.3	0.0	0.0	0.0	...	...	0.0
Number of days excluding days of precipitation	...	...	...	...	3.9	13.0	17.5	16.8	7.1	0.0	...	...	58.6
Class II: (2)													
Total number of days	...	...	...	...	2.6	4.6	3.9	2.8	5.0	0.0	...	...	19.9
Number of days on which there was precipitation	...	...	...	...	0.0	0.0	0.0	0.0	0.0	0.0	...	...	0.0
Number of days excluding days of precipitation	...	...	...	...	2.6	4.6	3.9	2.8	5.0	0.0	...	...	19.9
Class III: (3)													
Total number of days	...	...	...	...	7.5	5.1	3.1	2.7	9.0	0.0	...	...	27.4
Number of days on which there was precipitation	...	...	...	...	0.0	0.0	0.0	0.0	0.0	0.0	...	...	0.0
Number of days excluding days of precipitation	...	...	...	...	7.5	5.1	3.1	2.7	9.0	0.0	...	...	27.4
Precipitation:*													
Total number of days	0.5	0.2	0.6	0.3	0.3	0.0	0.0	0.0	0.3	0.3	0.9	0.7	4.0
Number of days in Classes I, II and III	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Number of days not in classes I, II and III	0.5	0.2	0.6	0.3	0.3	0.0	0.0	0.0	0.2	0.3	0.9	0.7	4.0

Of 4.0 average total number of days of precipitation, none occurred during cold weather.

WEATHER CONDITIONS AFFECTING OUTDOOR CONSTRUCTION
YOUR CITY

Average number of working days in each month on which there was precipitation* or freezing weather during working hours.

Class I: (1)	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total
Total number of days	...	...	...	...	...	...	...	...	...	...	...	...	...
Number of days on which there was precipitation	...	...	...	...	...	...	...	...	...	...	...	...	...
Number of days excluding days of precipitation	...	...	...	...	...	...	...	...	...	...	...	...	...
Class II: (2)													
Total number of days	...	...	...	...	...	...	...	...	...	...	...	...	...
Number of days on which there was precipitation	...	...	...	...	...	...	...	...	...	...	...	...	...
Number of days excluding days of precipitation	...	...	...	...	...	...	...	...	...	...	...	...	...
Class III: (3)													
Total number of days	...	...	...	...	...	...	...	...	...	...	...	...	...
Number of days on which there was precipitation	...	...	...	...	...	...	...	...	...	...	...	...	...
Number of days excluding days of precipitation	...	...	...	...	...	...	...	...	...	...	...	...	...
Precipitation:*													
Total number of days	...	...	...	...	...	...	...	...	...	...	...	...	...
Number of days in Classes I, II and III	...	...	...	...	...	...	...	...	...	...	...	...	...
Number of days not in Classes I, II and III	...	...	...	...	...	...	...	...	...	...	...	...	...

*Precipitation—Rain, snow, or sleet of .05 inch and more per hour. (Water content.)
(1) Class I (colder days)—Days on which temperature fell below 18° at some time, or did not rise above 24° at any time.
(2) Class II (medium days)—Lowest not below 18°, but temperature reached or exceeded 25° during the day.
(3) Class III (warmer days)—Lowest between 25° and 32°.

year. Certainly, however, such information cannot fail to be a vast improvement over haphazard guesses about what is likely to happen in different parts of the country.

Architects, engineers, contractors and others connected with building construction will doubtless have many practical problems arise in the use of these tables. Discussion and the assembling and weighing of additional data should result in the evolution of a standard form which can be filled out according to local weather conditions in each community and will serve as a guide.

Building Conditions in the United States

Prepared by S. W. Straus & Company

Building on a Par with Last Year

PROSPECTIVE building activities in New York City showed a pronounced falling off in November, although reports of permits issued and plans filed throughout the rest of the country indicated that operations will be sustained, about on a par with last year. The reports for November cover 354 cities and towns. The loss in New York was sufficient to create a falling off for the entire country of 13 per cent. The decrease from October was 18 per cent. In the 25 leading cities the decrease in November was 16 per cent, and from October 17 per cent, although the cities of this class, outside of New York, maintained respective operations at slight variance with November, 1923.

Plans filed in the five boroughs of New York in November were $40,950,752 as compared with $78,160,829 in November, 1923, and with $59,002,991 in November, 1922.

Losses of considerable proportion also were shown in Los Angeles, Cleveland, Washington, St. Louis, Buffalo, Oakland, and Newark, N. J. Substantial gains were reported in Chicago, Detroit, San Francisco, Philadelphia, Boston, Baltimore, Milwaukee, Pittsburgh, Minneapolis, Cambridge, Mass., Portland, Ore., Denver, Birmingham, Utica, Seattle, Worcester, and Cincinnati.

The total for the 354 cities and towns for November was $250,477,492, compared with $288,330,263 last November and with $306,348,757 in October this year.

The Eastern section of the country, 100 cities reporting, showed a loss of 24 per cent from last year, the largest of any section. The Pacific Coast section, 79 cities reporting, had a loss of 10 per cent from last November. The Central West, 117 cities reporting, had a loss of only 1 per cent, and the South, 58 cities reporting, practically broke even with last November.

One of the most interesting features of the November figures was the comparisons between activities in the larger cities and in the country as a whole. During 1922, 1923, and early in 1924 about half of the building in the country was in the larger centers of population. For several months past the big cities have not been holding this ratio of activities, but during November they regained their old speed. The total for the 25 leading cities on a basis of permits issued was $152,970,467, or 60 per cent of the total of the 354 cities and towns reported in the S. W. Straus & Co. survey. Among these 25 cities, 17 showed substantial gains over last November.

TWENTY-FIVE CITIES SHOWING LARGEST VOLUME OF PERMITS FOR NOVEMBER, 1924, WITH COMPARISONS

		November, 1924	November, 1923	November, 1922	October, 1924
1.	New York—P. F.	$40,950,752	$78,160,829	$59,002,991	$60,519,647
2.	Chicago	29,264,990	27,130,550	20,443,000	23,830,350
3.	Detroit	11,422,294	8,390,556	7,734,527	14,952,086
4.	Los Angeles	9,754,196	13,512,042	11,355,710	11,057,277
5.	San Francisco	6,358,729	3,850,808	2,620,471	6,116,313
6.	Philadelphia	6,079,970	5,406,040	11,416,730	12,066,625
7.	Cleveland	4,330,800	6,905,900	3,805,150	5,702,150
8.	Boston—P. F.	4,197,586	2,448,612	1,938,322	3,712,274
9.	Washington, D. C.	3,833,421	4,414,861	3,258,652	4,048,236
10.	Baltimore	3,232,200	2,743,632	2,588,520	2,966,600
11.	Milwaukee	3,197,399	3,053,840	1,978,081	3,805,359
12.	St. Louis	2,682,910	4,571,525	2,850,789	9,032,225
13.	Pittsburgh	2,671,626	2,266,623	2,278,958	3,255,584
14.	Minneapolis	2,508,410	2,056,275	2,893,410	1,774,075
15.	Buffalo	2,457,537	3,281,000	2,569,000	2,591,712
16.	Cambridge	2,261,743	272,078	427,060	780,323
17.	Portland, Ore.	2,118,340	1,672,145	1,858,550	2,429,195
18.	Denver	2,114,350	1,142,000	1,322,720	2,769,200
19.	Oakland, Calif.	2,104,741	2,336,472	2,584,752	2,619,703
20.	Newark, N. J.	2,061,961	3,039,459	2,657,199	2,253,908
21.	Birmingham	1,933,498	802,126	469,104	2,487,594
22.	Utica	1,932,650	529,572	557,525	439,550
23.	Seattle	1,902,415	1,147,805	1,259,610	2,022,250
24.	Worcester	1,830,369	996,327	729,420	1,181,195
25.	Cincinnati	1,767,580	1,452,520	2,716,440	1,492,435
		$152,970,467	$181,583,597	$151,316,691	$183,905,866

Note—P. F. indicates figures are for plans filed instead of permits issued.

SUMMARY OF NOVEMBER REPORT BY REGIONS

No. Cities	Regions	November, 1924	November, 1923	October, 1924	Losses Nov.-Nov.	Losses Nov.-Oct.
100	Eastern	$105,030,625	$137,887,759	$135,136,091	$32,857,134 —24%	—$30,105,466
117	Central	88,048,761	88,914,998	103,881,822	866,237 —1%	—15,833,061
58	Southern	21,525,803	21,526,612	27,612,375	—809	—6,086,572
79	Western	35,872,303	40,000,894	39,718,469	4,128,591 —10%	—3,846,166
354 cities	Totals	$250,477,492	$288,330,263	$306,348,757	$37,852,771 —13%	—$55,871,265 —18%

Improving a Semi-Trailer Dump Body

Hoist and Dump Body Increase Effectiveness of Equipment for Use with Truck Tractors

STATE laws recently enacted governing the size of load hauled on highways and streets have caused many large hauling contractors to search about for ways and means of economically conforming with the law. The need for capacity loads is apparent to all, the problem being to distribute the load on the chassis. The Heil Company, Milwaukee, Wis., has installed a number of dump bodies and Hydro-Hoists on Warner semi-trailers for use with different truck tractors. The photograph below shows an 8-yard body and a No. 6 Heil hoist used with a Packard tractor. The weight of the load is distributed over six wheels, thus conforming with the laws which prescribe the amount of weight per square inch of the tire surface.

A PACKARD TRACTOR WITH WARNER TRAILERS EQUIPPED WITH HEIL NO. 6 HYDRO-HOISTS

The trailer has a fifth wheel attachment through which the power is transmitted from the motor to the hoist for dumping the load. The drive is mechanical throughout, no piping being required, as the pump is an integral part of the hoist.

The dumping angle approximates 45 degrees, with a tail-gate ground clearance of about 4 feet. This makes a good unit for handling building supplies, sand and gravel, brick and other bulk material in cities and suburban towns where there is a serious problem in hauling a pay load economically.

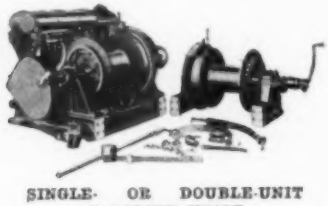
The body shown in the illustration is made with removable sides, all-steel tail-gate and front end, and a substantial steel subframe. The operating rods for the tail-gate are under the extended run-boards, where they are protected from jamming.

A Standard Hoist with a Fordson Motor

Provides Ready Service Without Need of Coal or Electric Wires

A NEW combination of the Flory hoist with a Fordson gasoline motor has been developed by the S. Flory Manufacturing Company, Bangor, Pa., and should be of interest to contractors in all fields. Every part of the hoist is a standard Flory part and interchangeable, and the motor parts can be secured at the nearest Ford service station.

A clutch between the motor and the driving gear makes it easy to start the engine. A winch head is furnished on the rear drum shaft and is a distinct convenience. The motor reduction gearing is of cast steel with machine-cut teeth.



SINGLE- OR DOUBLE-UNIT GASOLINE HOIST

The governor is set at 1,050 r.p.m. and automatically feeds gasoline in adjustment with the load. Gas and spark throttles are used only in starting, stopping or running light.

Both drums are equipped with a shrouded ratchet ring for holding the load suspended. This ring is easily replaced if damaged, as it is not cast to the drum. Both drums are equipped with pawls. Band type brakes with asbestos woven lining are arranged for stopping the drums in either direction of rotation.

The main housing for the machine is bolted to the bed plate, the housing and the bed plate being cast separately. In case of breakage of either one, only that need be replaced. The drums are brass-bushed where they run loose in the shaft. The hoist is mounted on heavy wooden skids and can handle a single load of 4,000 pounds on a single line at 125 feet per minute. The drums are interchangeable, and it is possible to attach the second drum very easily to a single-drum unit, thus converting a single unit into a double-drum outfit in short time.

A KOEHRING 21-E PAVER WITH 45-FOOT BOOM, USED BY CLAYTON CONSTRUCTION COMPANY IN BUILDING DOUBLE-SECTION SEWER IN MILWAUKEE

Pavers Used on Sewer Job

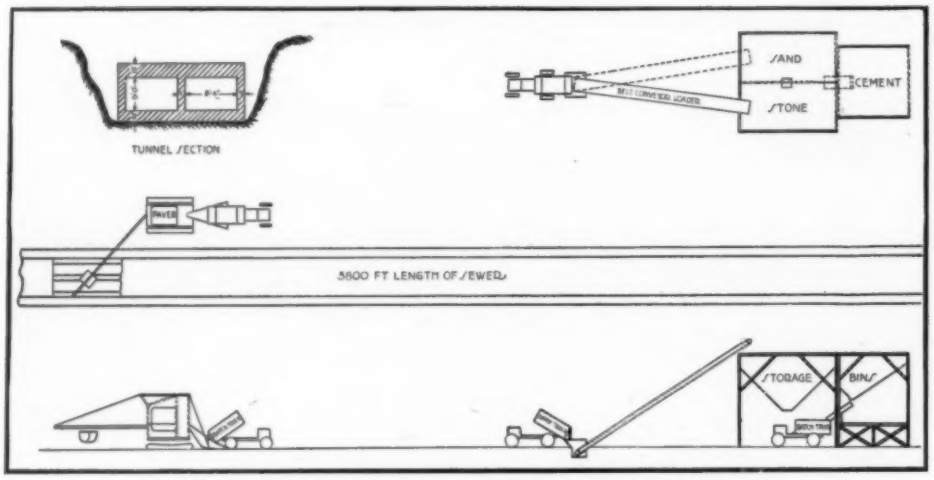
3,200-Foot Sewer in Roosevelt Drive Built Quickly Through Use of Material-Handling Equipment

A SEWER project in the northwest section of Milwaukee just outside the city limits along Roosevelt Drive is being pushed to completion before the area is annexed to the city and divided into lots for residence purposes. The contract is divided into two parts, consisting of a 3,200-feet double-section square sewer and a 6,000-foot round sewer.

The main sewer is 3,200 feet long and 8 feet 10 inches high from the bottom to the top of the concrete work, with an opening 6 feet high, and is 19 feet 9 inches wide. It is a two-section square sewer, each section of which is 8 feet 6 inches wide. The outside walls are 1 foot thick, the top walls 18 inches thick, and the bottom walls 16 inches thick, with a 9-inch center wall.

Because of the width of this work, which was well over 25 feet, the Clayton Construction Company, contractors for the job, decided to use a paver for the concrete work on account of its mobility. A special 45-foot boom was furnished by the Koehring Company and attached to the contractor's 21-E Koehring mixer. The contractor built a support which was moved by two men as the work progressed, so that the boom was propped at its outer end. This arrangement

KOEHRING 13-E PAVER USED BY THE GEORGE F. ZIMMERMAN CONSTRUCTION COMPANY IN THE CONSTRUCTION OF 6,000 FEET OF 6½- TO 8-FOOT ROUND SECTION SEWER IN MILWAUKEE



CONSTRUCTION LAYOUT ON CLAYTON CONSTRUCTION COMPANY JOB

allowed ample room for reaching the farthest side of the forms and at the same time permitted the paver to work at a safe distance from the edge of the cut.

A central proportioning plant equipped with Butler bins and a Barber-Greene belt-conveyor loader was built midway from each end of the job, making the maximum haul of the three trucks approximately 1,600 feet. Work was started June 12, 1924, and completed about September 6. An average of 76 lineal feet of sewer was completed each working day, comprising the use of 1,100 bags of cement a day used in a 3-bag batch proportioned 1:2:4. This total required 6 cars of sand and stone a day. Mr. Clayton was exceedingly well pleased with his layout and with the smoothness and dispatch with which the work was completed.

Connecting with this main double-section sewer is a single-section round sewer, 6,000 feet long and with a diameter varying from 6½ to 8 feet. The George F. Zimmerman Construction Company has the contract for this work and is using a Koehring 13-E paver with a standard 20-foot boom. The Zimmerman job was started August 1 and completed in December. The sewer is built on a concrete slab 12 inches thick on the sides and from 16 to 18 inches thick in the center. At one end the sewer is built in two sections, 6½ to 8 feet in diameter, to connect with the large main sewer. The remainder is built in a single section 6½ to 7 feet in diameter.

Because of the swampy nature of the ground and the large amount of water in the bottom of the ditch, it was necessary to use a very dry batch. Four shovelfuls of hydrated lime were mixed with each batch to give the concrete additional smoothness. Since the start of the work the paver has averaged well over 600 bags of cement per day, easily handling the dry batch with speed.

After the bottom concrete was placed, the circular forms were inserted, and the concrete was poured. The forms were removed at the end of each day. Twenty men comprised the working crew. Both the contractors handling these jobs have expressed themselves as well pleased with the speed of the paver, which was able to move along under its own power as the work progressed.

Miscellaneous Notes

C. D. Edwards Manufacturing Company Expands

THE C. D. Edwards Manufacturing Company, Albert Lea, Minn., has announced that J. W. Hutchinson, formerly General Manager of Smith & Sons Manufacturing Company of Kansas City, is now associated with it, and will have charge of the sales of the Edwards line in the western portion of the United States. His office will be located in California or Washington.

The first unit of the new Edwards factory is now completed. It is a warehouse 210 feet long by 90 feet wide, with brick walls and concrete floor. Within another six months the first factory unit will be started, and will be the same size as the warehouse and placed at right angles to it. The foundry, 100 feet square, will follow, together with several small outbuildings which are needed for the storage of raw materials, coal and coke.

Thorough tests have just been completed, so that the C. D. Edwards Manufacturing Company is now placing on the market a 2,900-pound, 7-foot grader, built along the same lines and design as its other models. It will be known as the Edwards Chief Standard. At the opening of the spring season this company will have two graders in the 7-foot field, namely, the Lighting Standard, weighing 1,800 pounds, and the Chief Standard, weighing 2,000 pounds.

Important Points for Wire Rope Users to Keep in Mind

You Can Seriously Impair the Value and Life of Even the Best Wire Rope by Improper Handling

WHEN correctly used, wire rope is the most dependable of all structural materials, but it is also the most easily abused. The destructive causes that shorten the life of wire rope can all be avoided by adhering to a few simple rules and practices, which might be summarized somewhat as follows:

1. Use care and judgment when unloading heavy coils and reels so as not to injure the rope.
2. Do not let wire rope coils or reels lie in water.
3. Do not expose wire rope to the direct rays of the sun or to the elements for a long time before using. Keep under shelter until ready to use.
4. In uncoiling wire rope avoid kinks. Kinks are bound to occur and ruin a rope if an attempt is made to pull out the loop by exerting tension.
5. Avoid abrasion. This calls for careful and frequent inspection.
6. Use sheaves and drums of proper diameter to prevent excessive bending of the rope.
7. Avoid reverse and short bends wherever possible.
8. Use thimbles in connection with attachments wherever possible.
9. Do not run wire rope over sheaves having broken flanges.
10. Do not run wire rope over sheaves having eccentric bearings or where the bore of sheave has been worn eccentric. Constant vibration due to eccentricity of bore or bearing is bound to crystallize the rope.
11. Align the sheaves properly so as to avoid unnecessary chafing.
12. Align the hoist drums with lead sheaves so that the rope will wind properly on drum.
13. Avoid careless operation.
14. Avoid unnecessary whipping and dropping of the rope.
15. Thoroughly lubricate the wire rope with a lubricant which will not only penetrate to the hemp center, but will also thoroughly cover the inside wires of the strands.

Suggestions on Handling

The first four points in this list warn against careless handling that damages wire rope before it is even placed in service.

Large wire rope reels are sometimes dropped from cars, regardless of the obstruction which may lie in the way of the reel. Many a wire rope has been injured by thus coming in contact with a sharp rock or other form of obstruction. The proper way to unload a reel or heavy coil of rope is to bring several heavy planks or timbers on an incline up to the side of the car and then lower the reel or coil to the ground by slowly rolling or sliding it down the inclined timbers.

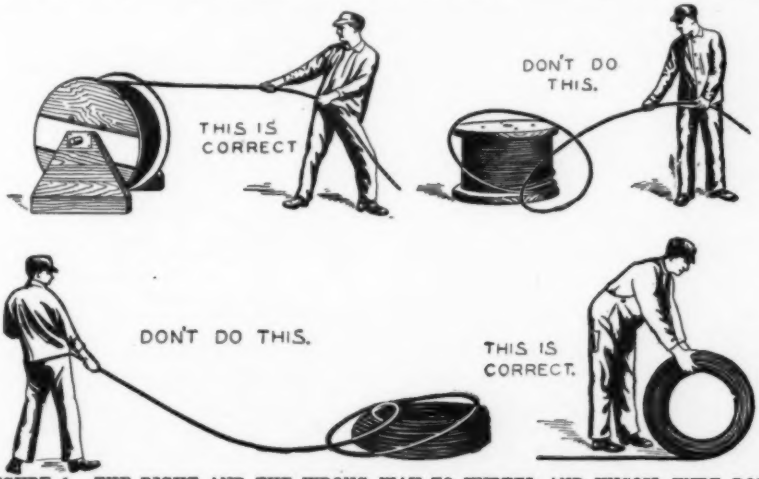


FIGURE 1.—THE RIGHT AND THE WRONG WAY TO UNREEL AND UNCOIL WIRE ROPE

Wire rope is sometimes ruined by dropping the reel or coil into water containing acid or other destructive agencies. Rope exposed to the elements for any considerable length of time before being put into service will have a tendency to rust. If exposed to the sun for a long time the core will have a tendency to dry out, thus reducing the wearing quality of the rope. Placing rope under shelter before putting into service is strongly recommended.

Kinking the rope by careless uncoiling is another common abuse. The coil should always be held in a vertical position and rolled along the ground like a wheel. If on a reel, mount the reel so that it will revolve and run the rope off straight ahead.

Figure 2 shows how a kink is produced from a

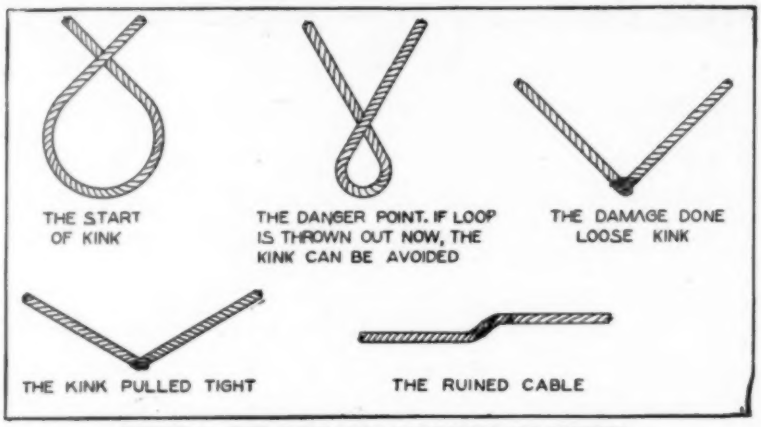

THE START OF KINK
THE DANGER POINT. IF LOOP IS THROWN OUT NOW, THE KINK CAN BE AVOIDED
THE DAMAGE DONE LOOSE KINK
THE KINK PULLED TIGHT
THE RUINED CABLE

FIGURE 2.—HOW WIRE ROPE IS DAMAGED BY KINKING

simple loop in the rope. These loops should be carefully guarded against and thrown out before much pull is brought on the rope. A straight pull on the rope only draws the loop more tightly into a kink Then the damage is done, and later, when the rope is carefully straightened out, wires will be found broken and strands twisted out of place.

Dragging the rope over sharp obstructions and making short bends when putting the rope in place also come under the heading of careless handling and should be avoided.

Abrasion

One of the worst enemies of good wire rope service is abrasion. Many wire ropes have been condemned as "rotten" when the fault was entirely due to abrasion. Some work, such as excavating with a slackline cableway or power drag scraper, for instance, requires that the cables must come in contact with sand and gravel, or similar abrasive materials. The operator who operates such equipment can, however, avoid considerable abrasion by using some care in bringing the ropes clear of the material whenever the conditions allow.

Abrasion is further caused by poor alignment of sheaves and hoist drums, by sheaves with broken flanges, by sheaves with eccentric holes or bearings, by sheaves which refuse to turn, or by obstructions in the path of the rope. There is one way to avoid abrasion and that is careful inspection and prompt removal of the cause of the abrasion after it has been located.

Undue and Short Bending

Excessive bending causes the ruin of many wire ropes. The destructive effect of this abuse has not been sufficiently understood, and owing to this fact, bending has not received the proper attention. The stress set up in the individual wires of the rope by bending it around too small a sheave or drum may exceed the stress of the dead load itself as far as the effect on the rope is concerned. The wires break off short or "porcupine." The obvious remedy is to install a sheave or drum of larger diameter; but if conditions make this impossible, then the next best move is to use rope of greater flexibility.

Theoretically, the curvature should be such that the bending stress resulting therefrom added to the load stress will not produce a tension in the wires exceeding the elastic limit.

Short bends are also very destructive to wire rope. One of the most common places to find short bends is at the point of attachment. The thimble, if properly used, does away with considerable of this short bending and also helps to distribute the load among the different strands.

Poor Installations

In the long run, the cheapest rope for the user is the one that gives him the greatest service per dollar of cost, and this is possible only when the rope is rightly constructed of the proper grade of steel for the work at hand.

For example, in excavating sand and gravel with a slackline cableway excavator or power drag scraper, a rope made up of six strands of thirty-seven wires to a strand will not last very long. The wires are too fine. Another rope of the same diameter and of much the same general appearance, but designed to withstand the abrasive effect of sand and gravel, will render much better service.

Installations where sheaves are poorly aligned so as to cause chafing and abrasion, where sheaves are used of very small diameter, where the wire rope is made to take numerous or reverse bends, are faulty and indicate that the designer lacked experience in wire rope engineering.

Careless Operation

When a particular grade of rope, after giving excellent service at a certain plant for years, suddenly falls 'way below its past good record, investigation often reveals the presence of a new and inexperienced operator He starts and stops the machinery suddenly, handling the levers carelessly without any regard to the vibration and shock caused by throwing the hoist drums into operation. Constant shock and vibration is bound to ruin the best rope. Wire rope does not require "nursing," but it does require the usual care that is generally given other equipment. Another product of careless operation is the "whipping" of the track cable, which in time is bound to crys-

tallize and break the wires.

Lubrication

Poor lubrication or entire lack of lubrication has in many cases been responsible for poor rope service. A proper lubricant will not only lubricate the wire and strands, but will also protect the rope against the corrosive action of moisture, acids, etc. Furthermore, it will penetrate the inside wires and also work in between the wires and the hemp center, reducing internal friction. A lubricant that merely acts as a coating on the outside wires should not be considered at all.

ACKNOWLEDGMENT.—Printed through the courtesy of *Sauerman News.*

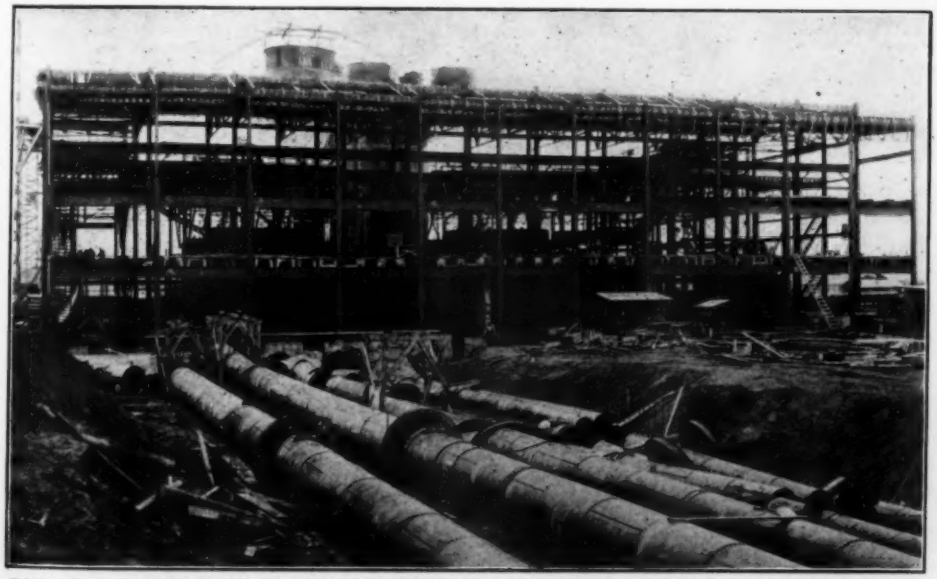
Erecting 1,000 Tons of Structural Steel in 42 Days

Remarkable Record by Booth & Pomeroy on Power-Plant for Longview Company

ORDINARILY the erection of the steel frame for a power-plant the size of that constructed for the Longview Company of Longview, Wash., would have required fully 100 days, but Booth & Pomeroy, Portland, Ore., rushed it through in 42 days. Over 1,000 tons of structural steel, manufactured by the Kansas City Structural Steel Company, was used in making the framework, which measures 220 x 300 feet and is 84 feet high. The Boyer pneumatic riveting hammers and 1-R drills were operated by Ingersoll-Rand air compressors, and American Hoist and Derrick rigs were used. All of this, with skilled union labor, aided in speeding up the work. Other recent jobs which have been handled by Booth & Pomeroy include the erection of the 4-span steel drawbridge over the Columbia River at the mouth of the Cowlitz River. The construction of this bridge was completed in 97 days, although it was admittedly a 6-months job. Efficiency both in equipment and in labor made these two feats of rapid construction work possible.

In the summer of 1922 construction work was begun on the city of Longview, Wash. This gigantic project, which is now in its second year, has included the grading of 44 miles of streets, 6 miles of concrete paving and 24 miles of gravel paving, 15 miles of sanitary sewer, and 7 miles of storm sewer, 17 miles of concrete sidewalk, and 14 miles of water-mains. The building program included the erection of nearly 600 homes, 25 modern business buildings, a 6-story fire-proof hotel containing 200 rooms, a community house, mills, docks, a 4-span steel railroad drawbridge, and a new railroad. Each project has been finished in record time, for the immense fir forests in this section are to be tapped by the Long-Bell Lumber Company and they wished to enter the territory as soon as possible.

The power-plant pictured in the process of construction will furnish electricity for the logging and milling operations, in addition to supplying light and power for many consumers in the city.



LONGVIEW POWER-PLANT UNDER CONSTRUCTION BY BOOTH & POMEROY, OF SEATTLE, WASH.
This illustration shows the pipes for the transformer cooling system in foreground

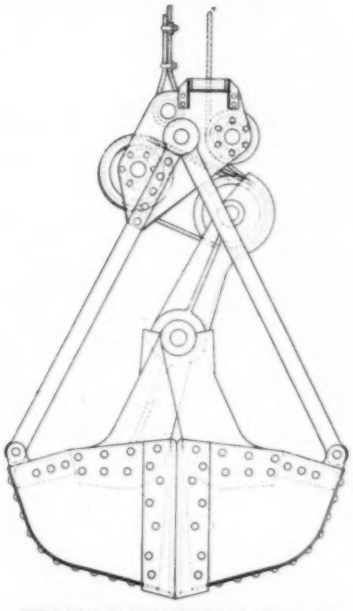
New Clam-Shell Bucket and Improvements in Fordson Creeper Loader Outfit

THE Geo. Haiss Manufacturing Company, Inc., 142nd Street and Park Avenue, New York City, has brought out a lever for a clam-shell bucket which will give the bucket a high-closing purchase of 1:5. The bucket can also be reeved 1:4 and to 1:3, where higher speed and less digging power are required.

The bucket shells have the general contour of the Haiss high-power bucket and are also equipped with steel castings to reinforce the back bend and also take the connecting rods from the head. The jaws run from the top of one side across the bottom to the other side, thus greatly increasing the stiffness of the shell bowl. The thickness of the shell varies from ½ to 1 inch, depending upon the weight of the bucket. All the cables have a straight pull, and there are no bends. The buckets are built in sizes from ¾-yard up and have as principal features large steel sheaves, wide bearings, and heavy shafts, all of which make for long wear.

This company has also announced several changes in the Haiss-Fordson creeper loader. The slow-speed drive is now actuated through a pair of spur gears instead of a chain as formerly. The supporting frame of the elevator has been lowered in height, allowing the machine to go over uneven ground without any danger of tipping. The weight of the loader has been increased to 11,000 pounds. The creeper tread links have been redesigned so that it is impossible for mud or dirt to wedge them.

The Haiss Manufacturing Company has also announced additional improvements in its loader and a crawler traction for Fordsons which will be described in a future issue of CONTRACTORS' & ENGINEERS' MONTHLY.



THE HAISS CLAM-SHELL BUCKET

THE IMPROVED HAISS CREEPER LOADER WITH SELF-FEEDING DEVICE

New Machine Shop and Assembly Floor

The Construction Machinery Company, Waterloo, Iowa, now has under construction additional floor space amounting to 22,000 square feet at its Waterloo plant. The majority of this additional plant space will be utilized for the machine shop and assembly floor. The total area of the completed plant, including the foundry department, will take approximately 80,000 square feet. This company manufactures Wonder concrete mixers, hoists, back-fillers and diaphragm pumps.

Universal Crane Enlarges Offices

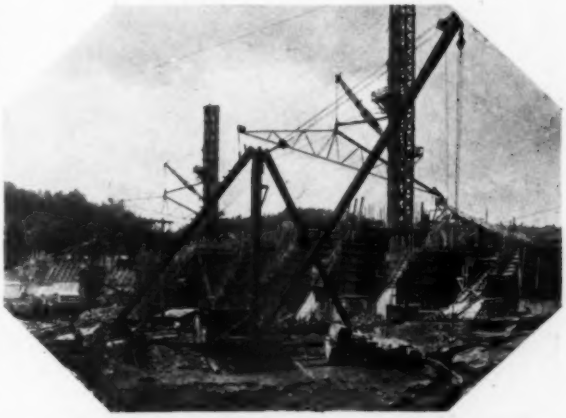
Because of the growth of the business of the Universal Crane Company, the general offices of the company in Cleveland have been considerably enlarged, but the location, Ninth and Euclid Avenue, Cleveland, near the Statler Hotel, has not been changed. The new quarters are in Suite 914, instead of 1106, as formerly.

Concrete Chuting Plants

Interesting Facts Regarding This Method of Speeding Up Concrete Construction

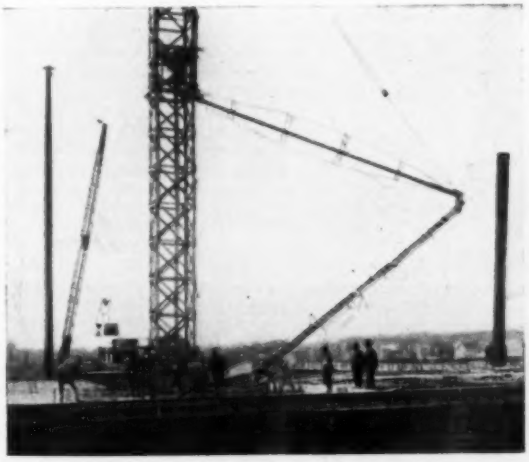
A CHUTING plant may be used in two ways: it may be designed to deliver the concrete to floor hoppers at central points on the work, or the plant can be laid out for pouring direct into the forms. To determine which method should be used, required the study of each particular job. There are three types of chuting plants in use: first, the boom plant; second, the unit plant; and, third, the continuous line plant. There are various possible combinations of the three types, but, as a general rule, the boom and unit plants apply almost entirely to building work, and the continuous line plant to dams, bridges and work of that character.

In general, a chuting plant consists of an elevator bucket which operates in a tower, and a tower hopper which may or may not be mounted on a sliding frame, and the necessary chutes for covering the job. A properly laid-out chuting plant should produce a marked saving of time and labor. The amount of concrete which can be placed is limited only to the capacity of the mixer and the forms available. The point of pouring can easily be diverted from place to place without its being necessary to take up and replace runways. More continuous operation of the mixing plant will be secured, which naturally means more economical operation. Furthermore, on account of local conditions on a construction job, it may be impossible to place the mixing plant exactly at the building, or the concrete may have to be carried over a stream or other obstruction. On such jobs the chuting plant provides a method for solving the problem economically.



A TYPICAL BOOM PLANT FOR PLACING CONCRETE

The chuting plant can no longer be considered a one-job installation: it is durable and easy to move; it is composed of standard, interchangeable parts which can be fitted and rearranged to meet practically any job requirements. The interchangeability of the various units also means quicker erection, and it is important in purchasing a chuting plant to see that interchangeability of parts is secured. This is a feature of the chuting equipment of the Lakewood Engineering Company, Cleveland, Ohio. A chuting plant is really a machine, and to secure the results desired must be correctly applied to the work at hand and properly operated.



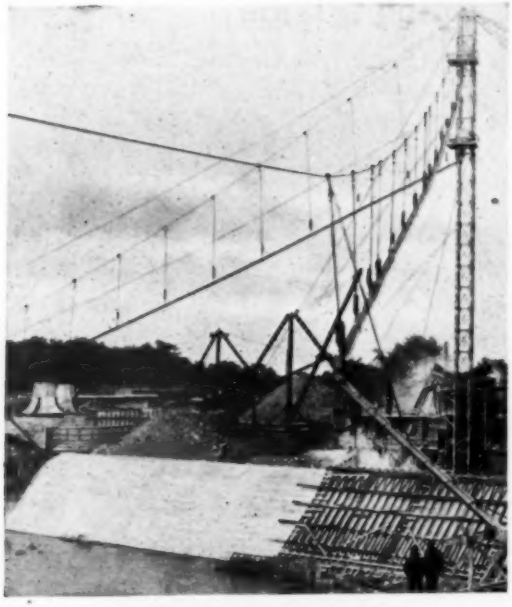
A UNIT PLANT COMBINING THE STEEL BOOM WITH THE FIRST SECTION OF THE CHUTE

Consistency of the Concrete

The general statement is sometimes made that to chute concrete an extremely wet, sloppy mix is required. As a matter of fact, a very sloppy mix will cause continuous trouble with any chuting plant, for the reason that the mix separates in the chute, the grout leaving the heavier aggregates stranded, thus causing clogging. Practical experience has proved that a good, creamy, workable mix can be handled the easiest in a chuting plant providing the proper slope for the chute is maintained, and has proved also that excessively wet batches or flat chute lines are almost entirely responsible for difficulties experienced with a properly laid out plant. Concrete varying in slump under the standard "slump test" from 3 to 6 inches can be handled satisfactorily in chutes.

Slope of Chute Line

For chute lines not over 175 feet long, a slope of not less than 1 to 3 is recommended, and on that slope a good concrete



A CONTINUOUS LINE PLANT

mix can be handled satisfactorily. On lines longer than 175 feet, a 1:2¾ to a 1:2¼ slope, depending upon the capacity desired, the length of the line, and the type of aggregate used, is recommended. It has been demonstrated that concrete much dryer than that ordinarily used in building construction can be placed with chute on the slopes mentioned above.

Relation in Size of Buckets, Hoppers, Etc.

There is a general rule covering the size of bucket and hopper to be used with a given size of mixer, which in general can be stated as follows: The working capacity of the elevator bucket should correspond with the wet batch capacity of the mixer. The tower hopper should have at least 50 per cent greater working capacity than the bucket to provide extra storage capacity in case of a hold-up of the concrete.

Capacity and Length of Life

The Lakewood standard chute has a body of 12-gage plate and a large cross-sectional area. This gives, in addition to its greater capacity, 40 per cent more wearing thickness of body than chutes made of 14-gage plate. The life of a chute section depends on so many variables, such as the type of sand, type of heavy aggregate, and care given the chute, that it is quite impossible to make a general statement which covers all cases. Chutes can be relined with liners of a thickness depending upon the yardage to be handled.

The Steel Tower

The fundamental feature of the modern chuting plant is the steel tower, as it is one of the most permanent parts of the contractor's plant for placing concrete. The Lakewood tower is made up of standard interchangeable sections, can be varied in height as conditions demand, and can be erected very quickly because it is framed and punched to template; it has great rigidity and strength and will outlive 15 to 20 jobs if given proper care as to painting and storage.

Factors of Success of Chuting Plant

The success of a chuting plant and the satisfaction secured from it both from the contractor's and from the engineer's standpoint are dependent upon certain definite things: first, a good workable concrete, not a sloppy, extremely wet mix; second, securing as nearly as practicable the same consistency of concrete, batch after batch, from the mixing plant; third, an experienced, capable man regulating the flow of the concrete into the line from the hopper; and fourth, a properly laid-out plant. The importance of this last item should not be underestimated.

The Use of Large Aggregate in Chuting Plants

There is an increasing demand for greater hourly capacity in chuting equipment and also for a chute that will handle aggregate running to 6 and 8 inches in size. This is particularly true of dam construction, a type of construction from which a chuting plant is generally a most valuable unit. To meet these requirements, there has been developed a modification of standard Lakewood chuting plants and also a special chute 18 inches in diameter.

For small dam projects and for heavy mass concrete jobs, standard chutes with arched bands and reliners can be used. These chutes on a 1:2¼ slope will handle all the concrete which can be supplied by two 1-yard mixers working under average conditions, and it is particularly fitted for large aggregate because of the elbow connections and the shape of the chute itself. The Lakewood elbow connection gives a 14-inch diameter full circle with all working parts on the outside of the connection, thus eliminating the clogging experienced with some types of chute construction.

Where unusually hard aggregate is to be used or where enormous yardages are desired without taking the chute down for relining, 3/16-inch reliner plates are recommended. Reliners of this thickness have been furnished on many jobs, and records are available of their handling 75,000 to 125,000 cubic yards of concrete without relining. These heavy reliners are bolted into the chute and are intended for use in long continuous line chutes or counterweight sections, but not in the sections which must be continually moved by workmen as the pouring progresses.

The 18-inch chute is intended for those dams and larger concrete projects where two or more 56-S mixers are to be used. It is identical in cross-section and general construction with the arched band standard chute, but changed as to the weights of materials and general dimensions. On the Shawinigan Engineering Company job at Montreal, Que., three towers were used. The chutes handled 149,000 yds. of concrete in 7 months.

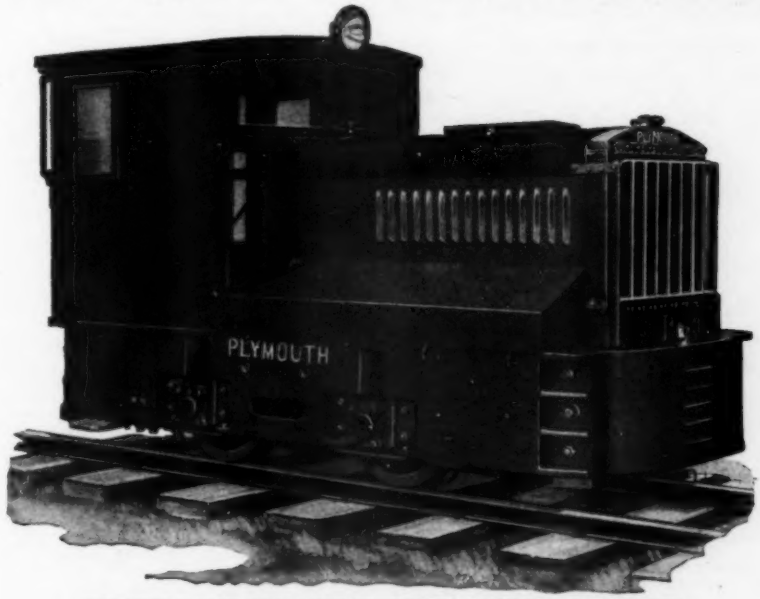
A New 8-Ton Gasoline Locomotive

Lengthy Work-out Under Trying Conditions Proves Value of This Hauling Unit

A NEW gasoline locomotive known as Model DLC Type 6, weighing 8 tons, has recently been brought out by the Fate-Root-Heath Company, Plymouth Locomotive Works, Plymouth, Ohio. This locomotive, before being announced by the manufacturers, was put through a series of lengthy try-outs under decidedly trying conditions and came through with remarkably favorable reports.

The locomotive is equipped with a Climax model TU 4-cylinder engine, developing 65 horsepower at 900 r.p.m., a Bosch high-tension magneto with impulse coupling, Simms 12-volt starter and Willard storage battery, a Stromberg carburetor and a United air cleaner and built-in governor. The engine is cooled by a Modine sectional core radiator and a 22-inch gear-driven fan. Because of the rough work which the locomotive is bound to get into, the radiator is protected by a heavy guard.

The transmission is of the Plymouth sliding-gear type with four speeds forward and reverse. The 4-7/16-inch axles are of alloy steel heat-treated. The 24-inch wheels are rolled steel. The brakes on all four wheels are of the lever type, and sand is delivered by a hand lever to all four wheels. This new unit is built with a high cab, measuring 84 inches in height over all, enabling the operator to see over the industrial cars which it is hauling. The cab is provided with a side entrance with sliding steel doors, avoiding the danger of exit between the locomotive and the car, as in the case of rear opening only. Speeds of 2½, 4, 8 and 12 miles per hour at an engine speed of 900 revolutions per minute are possible. The draw-bar pull at 2½ miles per hour with sand is 6,000 pounds, at 4 miles per hour with sand 4,800 pounds, without sand 4,000 pounds, at 8 miles per hour 2,400 pounds, and at 1,200 miles, 1,600 pounds.



THE NEW MODEL DLC, 8-TON PLYMOUTH GASOLINE LOCOMOTIVE

The Front Cover Illustration

WE are indebted to the Federal Truck Company of Baltimore, Inc., 410-418 West North Avenue, Baltimore, Md., for the interesting illustration appearing on this issue of CONTRACTORS' & ENGINEERS' MONTHLY. The Federal truck illustrated is owned by William Meyer & Sons, general contractors, Philadelphia Avenue and Fifth Street, Baltimore, and is shown handling an excavating contract for the James Keelty Company.

This truck was put on the job in March, 1923, and immediately placed at work. It is a 5-ton Federal with a Wood 4-yard steel body equipped with underbody hoist. The truck was one of nine on this job, four of which were Federals. The loads handled varied from 6 to 9 tons. The total excavation consisted of about 72,000 yards of rock. The job was completed in three months, during which the trucks operated on an average of about ten hours a day.

Useful Catalogs

The catalogs and pamphlets listed below are available for free distribution. Contractors and Engineers who check over these pages each month and write for such material as interests them, will find this a valuable means of keeping up to date on the subject of machinery and equipment.

DIRECT-CONNECTED HORIZONTAL PUMPS

Bulletin 22-WS, issued by the Domestic Engine & Pump Co., Shippensburg, Pa., describes its full line of direct-connected horizontal pumping engines and other units for furnishing water in moderate quantities from springs, cisterns or wells, in which there is not more than 25 feet vertical fall from the pump cylinder to the level of the water.

A SELF-CONTAINED PATCHER

Literature describing the Merrill patcher, manufactured by Chase & Lyman, Inc., 12 Pearl St., Boston, Mass., may be secured by any contractor interested in an economical unit readily operated by one man and so built that the bottom of the kettle cannot be burned out.

AIR-COMPRESSOR OUTFITS

Portable air-compressor outfits with steel or rubber-tired wheels to meet different road conditions and with team or truck hitch, equipped with Novo industrial type slow-speed, heavy-duty gasoline engines, are described in detail in a new folder, No. 267, which has recently been issued by the Novo Engine Co., Lansing, Mich.

A NEW MECHANICAL HOIST

The Heil Co., 1243 - 26th Ave., Milwaukee, Wis., will be pleased to furnish contractors complete information regarding the new Heil mechanical hoist based on the patterns of the Titan mechanical hoist which it has acquired.

NEW TRANSMISSIONS AND POWER-PLANTS FOR FORDS

A complete transmission consisting of sliding gears with three speeds for cars and four for trucks, to replace the planetary set in Fords and a complete replacement power-plant for these sturdy 1-ton trucks are described in the literature of Hinckley Motors, Inc., Box E-839, Detroit, Mich.

MOVING DIRT EFFICIENTLY

Catalog No. 42 issued by the Sidney Steel Scraper Co., Sidney, Ohio, describes this company's complete line of efficient dirt-moving machinery, including drag scrapers, wheeled scrapers, fresno scrapers, grading plows, all-steel barrows, wood frame barrows and contractors' barrows.

A CATALOG OF TRACTORS

The C. L. Best Tractor Co., San Leandro, Calif., has just issued a very complete and well-illustrated 56-page catalog, No. 616, which it will be pleased to send to municipal officials and contractors interested in knowing all about the Best line of tractors for grading, heavy hauling, snow removal and general industrial uses.

FACTORY FLOOR SURFACES

This is the title of a 34-page bound volume which has been published by the Aberthaw Co., 27 School St., Boston, Mass., drawing from the wealth of experience which this company has had in the construction field. The price of the book is $1, but the Aberthaw Co. will be pleased to send a copy without charge to engineers, builders and industrial owners to whom it would be of value.

DIGGER AND LOADER FOR TIGHT PLACES

Bulletin No. 12, issued by the Conveying Weigher Co., 90 West St., New York City, tells the story of the Conweigh digger belt loader, which has been used so successfully in tunnel work in different parts of the country.

COMPLETE TWO-UNIT ASPHALT PLANT

The Mosher asphalt plant, which is portable, being built in two units, has a capacity of 1,800 yards of 2-inch sheet asphalt or its equivalent per 10-hour day. It is described in literature which may be secured from the East Iron & Machine Co., Lima, Ohio.

LOW-COST HAULING WITH TRUCKS

A folder, "An Investment in Low Cost Hauling," has recently been issued by the International Harvester Co. of America, 606 S. Michigan Ave., Chicago, Ill., describing its various models of trucks for contracting work.

SINGLE- AND DOUBLE-DRUM GASOLINE HOISTS

A single-drum gasoline hoist outfit which can be quickly converted into a double-drum hoist, with a boom swinging gear attached if desired, has been placed on the market by the S. Flory Mfg. Co., Bangor, Pa., powered with a standard Fordson gasoline motor.

PERFECT CONCRETE SURFACES

The Berg concrete surfacer, which does away with hand labor, removing board marks and other blemishes from the surface of concrete work, is described in literature which may be secured gratis from Dept. CEM, Concrete Surfacing Machinery Co., 4659 Springgrove Ave., Cincinnati, Ohio.

ROAD-OILING EQUIPMENT

The Good Roads Machinery Co., Inc., Kennett Square, Pa., in its catalog KEL, describes the Champion road oiler which is a heater and distributor for mounting on motor trucks.

A NEW LIGHT-WEIGHT, HEAVY-DUTY TRUCK

Complete information regarding the new Bethlehem 7-speed "California Special," a light-weight, heavy-duty truck built particularly for road building, may be secured from the Bethlehem Motors Corp., 40 E. Walnut St., Allentown, Pa.

A NEW TYPE OF FLOOR AND ROOF CONSTRUCTION

The United States Gypsum Co., 205 W. Monroe St., Chicago, Ill., has just issued an interesting 16-page booklet describing Sheetrock Pyrofill construction for floors and roofs. The economy and value of this type of construction will be apparent to contractors and engineers examining this book carefully.

SPECIFICATIONS FOR A 21-S HEAVY-DUTY MIXER

The Koehring Co., Milwaukee, Wis., has just issued a very helpful 20-page booklet, "Specifications," covering 218 heavy-duty construction mixers. This book with its diversified information will be of interest to any contractor.

DEPENDABLE EXPANSION JOINTS

The life and economy of concrete, brick and other block type pavements depend on a satisfactory expansion joint to take care of the slight but exceedingly powerful movement of materials under the action of heat and cold. The value and dependability of Carey Elastite expansion joints for concrete roads, bridges, sidewalks and buildings are told in literature which may be secured from the Philip Carey Co., 9 Wayne Ave., Lockland, Cincinnati, Ohio.

52 YEARS' EXPERIENCE WITH DRAGLINES

The Osgood Co., Marion, Ohio, which has been building draglines since 1890, has published an interesting booklet, "52 Years' Experience," which is of value to users of revolving and railroad shovels, with continuous treads, traction wheels or railroad trucks.

PUTTING MATERIAL ON THE JOB

The Burch Plow Works, Dept. B-2, Crestline, Ohio, will be pleased to furnish any interested contractor with complete information regarding the Burch unloader, which takes material from cars with thoroughness and economy, and the Burch spreader, which puts an even layer of stone on the road at minimum cost.

ROCK ASPHALT IN ROAD WORK

Complete information regarding the economy, ease of laying and nature of Kyrock, the rock asphalt product of the Kentucky Rock Asphalt Co., Dept. CEM, 711-718 Marion E. Taylor Bldg., Louisville, Ky., may be secured from this company free on request.

KEEP JOBS OPEN IN WINTER

The Baker Mfg. Co., 585 Stanford Ave., Springfield, Ill., has issued a 48-page catalog which shows how Baker snow-plows are used by contractors and municipalities throughout the snow region for keeping main highways open as well as to permit the haulage of materials to construction jobs off the main roads.

SHOVELS THAT ARE JUST RIGHT

If you are interested in securing a shovel with the proper balance and one which holds its shape and has the proper handle, write to the Ames Shovel & Tool Co., Boston, Mass., for its latest descriptive literature.

TRUCKS DESIGNED FOR HARD WORK

The General Motors Truck Co., Dept. 49, Pontiac, Mich., will be pleased to furnish contractors with complete information regarding the use of GMC trucks on all kinds of construction jobs. These trucks, built for long life and hard labor, are described in detail in the latest GMC catalogs.

A DEPENDABLE TRASH PUMP

Catalog 28-A, issued by the Pacific Flush-Tank Co., 4142 Ravenswood Ave., Chicago, Ill., describes the Wood trash and sewage pump, which is capable of handling unscreened sewage containing trash and fair-sized stones.

CONCRETE MIXERS AND HOISTS

The American Cement Machine Co., Inc., Keokuk, Iowa, will be pleased to send its latest catalog on Packard tilter Ford mixers, Boss mixers from ½- to 5-bag sizes, and Boss hoists, to contractors interested in this type of equipment.

SATISFACTORY ROAD BINDERS

The selection of a binder for bituminous macadam roads and for surfacing and repairs is a matter of concern to the contractor as well as the municipal official. Complete information regarding the various grades of Tarvia and the uses to which they are adapted will be found in illustrated booklets of the Barrett Co., 40 Rector St., New York City.

A FREE BOOK ON SETTING CONSTRUCTION LINES

The Warren-Knight Co., 136 N. 12th St., Philadelphia, Pa., will be glad to send to any contractors and engineers a copy of its folder T-1 and free pocket notebook of instructions for quickly and accurately setting lines and levels on construction work.

TYPES OF PORTABLE CONVEYORS

The Portable Machinery Co., Inc., Passaic, N. J., will be pleased to send information to contractors regarding its various types of portable belt conveyors, suggesting the proper type for each kind of service.

THE SCIENCE AND PRACTICE OF INTEGRAL WATERPROOFING

In Booklet No. 134, the Truscon Laboratories, Detroit, Mich., gives a great deal of valuable information on the science and practice of integral waterproofing as applied to basements, cement stucco, reservoirs, cisterns, tunnels, stand-pipes, foundations, subways and masonry structures of all kinds.

ROLLER CONVEYORS

The Standard Conveyor Co., North St Paul, Minn., will be pleased to send its literature on various types of Standard roller conveyors for handling shingles, boxes, brick and other material which can easily be moved by gravity on a dependable roller conveyor.

SELF-DUMPING BODIES

The new Stewart quick-acting, self-dumping steel body for Ford trucks will be of interest to contractors wanting a body which dumps clean and saves time. Information regarding this outfit may be secured from the Stewart Iron Works Co., Inc., Cincinnati, Ohio.

A CONTRACTORS' EQUIPMENT EXPOSITION

The Ford Power Equipment Exposition, 54th St. and Broadway, New York City, the largest exposition of its kind in the world, contains exhibits of all kinds of contractors' equipment, powered with Ford or Fordson units. Complete information may be secured free on request.

AN OIL-BURNING ASPHALT HEATER

The "Hotatuf" asphalt and pitch heater, which has a sloping oven producing hot material as soon as the heater is started, is described in the literature of the Mohawk Asphalt Heater Co., Scotia, N. Y.

GUARANTEED WIRE ROPE

Williamsport Telfax tape-marked wire rope is used as standard equipment by many manufacturers of contractors' equipment because it is guaranteed. Complete information regarding this rope for all kinds of contracting work may be secured from the Williamsport Wire Rope Co., General Sales Office, Peoples Gas Bldg., Chicago, Ill.

BRANDED TOOLS

Tools that bear the indelible brand of the owner are not so likely to disappear from the job as those which bear no mark of identification. Complete information regarding low-priced Everhot equipment for quickly branding tools may be secured from the Everhot Mfg. Co., Maywood, Ill.

A TRUCK BUILT FOR ROAD WORK

The United "Constructor" is first and last a road constructor's truck, designed and built for one type of service and sold exclusively to contractors through reliable distributors of contractors' equipment. Contractors wishing complete information regarding this truck should write to the United Motors Products Co., Grand Rapids, Mich.

PICTURES OF MATERIAL-HANDLING JOBS

The Barber-Greene Co., 515 West Park Ave., Aurora, Ill., has published a particularly interesting booklet, "Mr. Barber's Scrapbook," which pictures the use of Barber-Greene loaders and material-handling equipment on all kinds of jobs.

AN ECONOMICAL GASOLINE INDUSTRIAL LOCOMOTIVE

In Bulletin B-1, the Brookville Truck & Tractor Co., Brookville, Pa., describes and illustrates the Brookville gasoline industrial locomotive with a Fordson power unit, which has proved its value in many contracting jobs.

HIGH-PRESSURE ROAD PUMPS

Pump Data Bulletin No. 82, issued by the Aldrich Pump Co., Allentown, Pa., contains a great deal of information of especial interest to contractors on high-pressure road pumps of various capacities with special features.

A ONE-SACK CONCRETE MIXER

The Jaeger 5-L mixer, which holds easily the right proportion for the ideal mix, 1:3:5, and which is equipped with the well-known Jaeger tilting drum, is described in literature which may be secured free from the Jaeger Machine Co., 701 Dublin Ave., Columbus, Ohio.

A RIGID METAL LATH

The General Fireproofing Co., Youngstown, Ohio, will be pleased to send information regarding G-F Herringbone double-mesh metal lath to any contractors interested in considering this material for plastering.

CONCRETE-PLACING EQUIPMENT

In Bulletin 23-E, the Lakewood Engineering Co., Cleveland, Ohio, gives a great deal of very helpful information regarding the use of concrete-chuting plants and illustrates a large number of jobs in which this type of equipment has been used effectively.

A DUMP-CAR WITH EXTENSION FLOOR

The Western extension floor or apron which can be attached to any Western dump-car in use and which is designed to throw the load beyond the ballast line of the track, is described in an interesting manner for the benefit of contractors and railway officials in Bulletin No. 22-J which may be secured free from the Western Wheeled Scraper Co., Aurora, Ill.

SAFE STAIRS AND STAIRWAYS

In a booklet entitled "Safe Practices," the American Abrasive Metals Co., 50 Church St., New York City, presents an orderly delineation of accident hazards and the present practices for their elimination, with particular reference to stairs and stairways.

HAND HOISTS FOR DUMP-TRUCKS

In Data Sheet No. 400, the Columbian Steel Tank Co., 1405-1625 West 12th St., Kansas City, Mo., describes in detail the Columbian Lightning hand hoist, which is used as standard equipment by many contractors on their dump-trucks.

LONG-HANDLED CEMENT-FINISHING TOOLS

Abrams double-action, long-handled cement-finishing tools for sidewalks, floors and road work, which make it possible for an inexperienced man standing on his feet to do the work of an experienced mason crouching over the job, are described in a new booklet which has just been issued by the Abrams Cement Tool Co., 3818 Grand River Ave., Detroit, Mich.

FREE BOOK ON POWER SCRAPERS

A small free book packed with useful ideas on how to save money in digging and moving earth and other loose materials, may be secured by any interested contractors or engineers from Sauerman Bros., 464 S. Clinton St., Chicago, Ill.

A COMPACT BLUE-PRINT DRYER

A blue-print dryer capable of drying 8 linear feet of dripping-wet blue-print a minute and which is particularly handy for offices where quantity production is necessary, is described in literature which may be secured from the C. F. Pease Co., 858 N. Franklin St., Chicago, Ill.

A 50-Horse-Power Three-Drum Hoist with Boom Swinger

Self-contained Unit Is Operated by Gasoline Engine

A HEAVY-DUTY three-drum geared hoist with a vertical multiple-cylinder gasoline engine for double-platform elevator work, bridge building, steel construction work, pile driving, the operation of derricks and concrete buckets, log rolling and decking, pulling cars up incline, dragline work, loading and unloading freight and other similar kinds of work, has been developed by the O. K. Clutch and Machinery Company, Columbia, Pa. The hoists are all equipped with 4-cylinder engines rated at 15 to 70 h.p. The heavy-duty engines with three drums and boom swinger are mounted on channels or I-beams which are turned up at the end to facilitate sliding and moving the complete unit.

A HOIST THAT WILL HANDLE EVERY HOISTING JOB WITHIN THE LIMIT OF ITS POWER

The heavy-duty gasoline engine is equipped with magneto, automatic governors, air cleaner and reduction gears running in oil. The free-running engine-clutch lever is located at the right of the hoist near the engine in a very handy position for the operator. At the center of the outfit is an extended control for the engine speed and governor, making a particularly handy device. The two back hoisting drums run in the same direction, making it easy to watch the hoisting rope from the top. The drums are equipped with extra large asbestos brakes for lowering the loads. The strong, wide-face, machine-cut tooth gears on the hoist drum are well guarded to prevent all possibility of accident.

The boom swinger, which is located at the extreme front of the machine, is simple, strong and compact. Extra-heavy steel-forged ratchet pawls are built in to hold the loads on each drum. All the foot brake levers, as well as the operating levers, are conveniently located on the right side of the machine to minimize the effort required of the operator. Reverse attachments can be added to any of these hoists, which are operated by a single lever. An independent winch can also be attached.

Plan to Adopt Standards for Steel Reinforcing Bars

STEEL manufacturers, big distributing interests, and consumer representatives meeting in the Division of Simplified Practice, Department of Commerce, have adopted eleven sizes of reinforcing bars as standard. The sizes are based on the area of the bars. This action, which will be effective on January 1, 1925, for manufacturers, and on March 1, 1925, for distributors who have stocks or current orders to be cleared before the completion of the action, will replace some 40 or more sizes at present in use.

In opening the discussion, A. E. Lindau, who represented the American Concrete Institute and the American System of Reinforcing, of Chicago, outlined the pre-war experience as to varieties demanded. He showed how in a single plan, 18 to 20 varieties of reinforcing bars were frequently called for, some with as little as 1/16 of an inch variation. The demand was curbed during the war, but has since backslid to nearly as great a variety as before. He declared that certain state highway departments have standard plans which include other than the suggested standard sizes, and that a certain amount of hesitancy might be found in their acceptance of the standards.

W. A. E. Doying, of the Panama Canal, spoke in favor of the proposed standards, as did also O. L. Grover of the Bureau of Public Roads, and A. W. Slater of the Bureau of Standards. E. F. Kelley, representing the American Association of State Highway Officials, and W. O. Irwin of Youngstown, Ohio, representing the Truscon Steel Company, discussed the new standards from the standpoint of highway construction. Mr. Irwin disclosed that from the distributors' standpoint, the present variety is tying up huge sums in stocks and that the consumer has to pay the interest on the investment. Pacific Coast points, he said, call for a greater variety of sizes.

George E. Routh, Jr., of the Kalman Steel Company, Chicago, recommended that the area of bars be considered for standardization, rather than the shapes, a position which was indorsed by Richard L. Humphrey of Philadelphia, who represented both the Committee on Standard Specifications for Concrete and the American Society for Testing Materials.

In consideration of the question of grades,—a proposition having come from several sources that one grade take the place of the existing three grades,—the statement was made that a committee of the American Society for Testing Materials is studying this subject, and it was decided to hold this question in abeyance until the next annual conference on revisions of the simplification adopted. The areas of the new standards in square inches are as follows: .049, 0.110, 0.196, 0.250, 0.307, 0.442, 0.602, 0.785, 1.000, 1.266 and 1.563.

Making the Crane Operator's Job Easier

"Feather-Touch" Lever Control Reduces Energy Required for Operating Power Shovels

FOR a number of years, engineers have attempted to reduce the physical effort required to operate power shovels by the use of steam and air rams. With an air or steam ram, there is no proportionality between the position of the operator's clutch lever and the amount of effort with which the lever is applied and the degree of application of the clutch. With the ram the clutch is either all in or all out, there being no intermediate position at which the operator can "feel" the effort which is necessary for placing his bucket or his load. It is for this reason that locomotive cranes, except in very large sizes, are not equipped with rams.

The installation of air rams is complicated, necessitating a compressor and drive, piping and valves, etc., which must be kept tight and are always in danger of freezing in cold weather. A special oil must be kept on hand for lubrication, and there is a total lack of positive release in the clutch.

The "feather-touch" lever control which has recently been brought out by the Northwest Engineering Company, 28 East Jackson Boulevard, Chicago, Ill., is not a substitute for the air or steam ram, but an invention which does away with their complications and disadvantages. The de-

THE MECHANISM THAT MAKES "FEATHER TOUCH" OPERATION OF THE LEVERS POSSIBLE

A NORTHWEST SHOVEL EQUIPPED WITH CRAWLER TREAD AND FEATURES TO MAKE LEVER CONTROL EASY

vice is a simple mechanism for the easy shifting of the clutches on Northwest shovels, cranes, draglines and trench pull-shovels which permits greater capacity. A touch brings instant action, a fineness of control combined with great ease and a sensitiveness which enables the operator to "feel" his way, making accurate handling possible. With the new "feather-touch" lever control the operator utilizes the power of the engine to shift the clutches, instead of his own muscular effort. In shifting them he simply throws the "feather-touch" mechanism into action; actually the clutches are shifted by the device itself. Release is accomplished in the usual manner. The clutches are pulled out by the hand lever when it is moved in the direction reverse to that required for engagement; thus disengagement is always positive.

It is claimed that with the "feather-touch" lever control, because the arc of travel of the levers is considerably less than was necessary with previous methods, there is a total of about 80 per cent effort eliminated, making the machine equipped with this control a very easily handled gasoline outfit.

Belt-driven Air Compressors

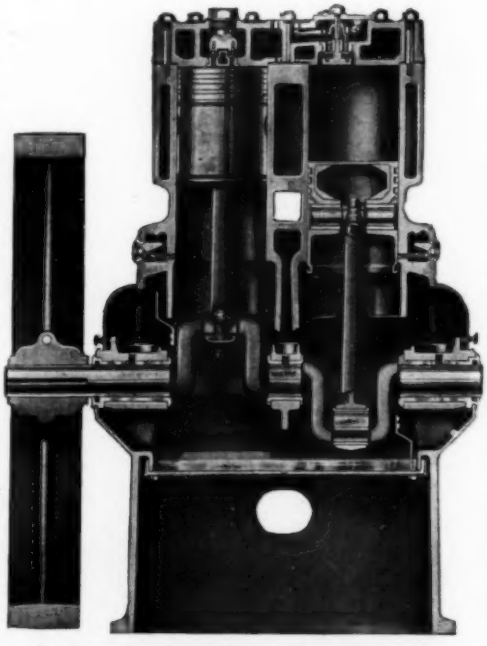
Single- and Double-Cylinder Models Are Full Self-Oiling and Have Sight Feed Cylinder Lubrication

CURTIS Model "A" air compressors are strongly built, well-designed units with wearing parts of generous proportions. They are automatically lubricated by a controlled-splash system with regulatable sight feed for cylinder oiling, and can be furnished with an air-pressure unloader if desired. These machines are made entirely at the plant of the Curtis Pneumatic Machinery Company, St. Louis, Mo., in single-cylinder models of 9 to 44 cubic feet capacities and in double-cylinder models from 29 to 250 cubic feet, operating at pressures from 100 to 200 for the single-cylinder type, and from 100 to 125 pounds per square inch in the double-cylinder type.

The manufacturers state that the Curtis compressor is the result of 29 years of experience, featuring simplicity, durability, economy and efficiency. It has an unusually large cooling surface for a single-acting compressor. The heads and valves are water-cooled, as well as the cylinder walls, thus increasing the volumetric efficiency. The machines are self-contained, and are built heavy enough to assure freedom from vibration, admitting of light foundations and withstanding the excessive strains due to speed and high pressure. The air-pressure unloader makes this compressor desirable for intermittent service. The controlled-splash oiling system with its regulatable sight feed of the oil fed to the cylinder, its consequent saving in oil and attention, is another feature. The discharge for the water circulation is taken from the heads, or in other words at the highest point of circulation, so that there is never any possibility of the hot water's becoming pocketed or trapped in the heads, and there is no possibility of water's circulating without passing through the heads and around the valves.

All contractors know that it is never advisable to run any machine in a place full of dirt and grit. This compressor, however, has the advantage of being fully enclosed, with no cross-heads, slides, guides, shoes or stuffing boxes, therefore it is a desirable piece of machinery, particularly where there is a great deal of dust and dirt.

The manufacturers recommend the flat-belt type of electric drive as preferable to either chain or gear drive, as it is more flexible, more nearly noiseless, less severe on the motor, and less expensive. Manufacturers desiring a silent chain drive or gear drive may secure it where desired upon order.



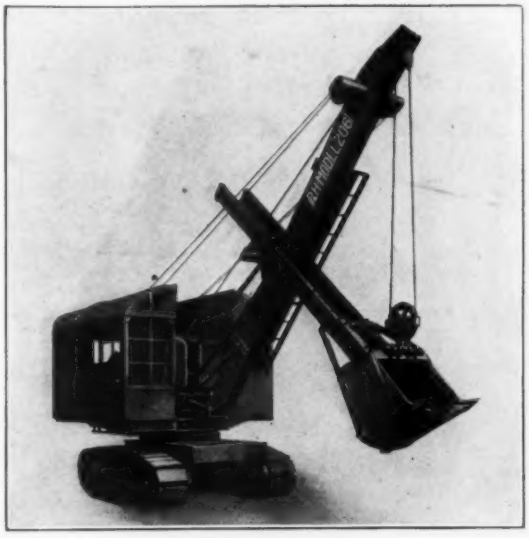
SECTIONAL VIEW OF CURTIS COMPRESSOR

The unloader automatically regulates the air pressure by unseating the suction valves at maximum pressure and reseating them at minimum pressure. No air is compressed in the meantime, the action of the fly-wheel is not stopped, nor the belt shifted, and the only power necessary is that to overcome the mechanical friction of the machine. A hand by-pass valve allows the compressor to be started unloaded even though there is full pressure in the tank, thus avoiding the usual starting troubles of slipping or throwing the belts, blowing out fuses or burning out the motor. The unloader can be set for any variation from ½ to 10 pounds.

All-Steel Cabs for Excavators

Neat Job Assures Complete Protection of All the Machinery and the Operator Against Bad Weather and Tampering

ALL of the ½-yard and ¾-yard capacity excavators now being built by the Pawling & Harnischfeger Company, Milwaukee, Wis., may be equipped with specially designed all-steel cabs, which not only give the machine a better appearance but assure complete protection of the machinery from the weather and from those maliciously inclined. The cab is provided with windows on each side of the operator so that, he may be fully protected from cold or dampness and still efficiently operate the machine. A swinging steel door is placed at each side of the machine to give complete access to all parts of the machinery. The doors are provided with latches and locks. The windows are protected by sheet steel covers which may be easily slipped into place when the machine is not being used. A rolled sheet cover is placed over the drums and gears with a narrow slot for the cables to lead through, which eliminates the heavy door that was formerly used and also gives a better protection.



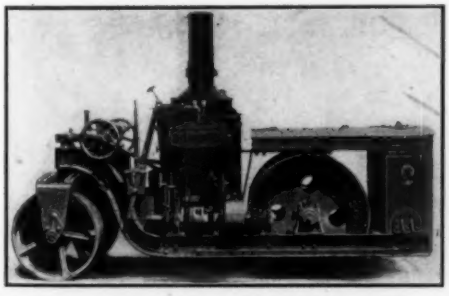
NEW CABS FOR P & H EXCAVATORS

Another new feature of all P & H Model 206 machines is a ¾-yard struck-measure dipper. The use of this dipper is said to substantially increase the output of the machine. The machines using ¾-yard heap measure dippers have established very good performance records, and it is now expected that new records will be set by the larger-capacity machines.

Tandem and Macadam Rollers

Steam-driven Machines of Sturdy Construction

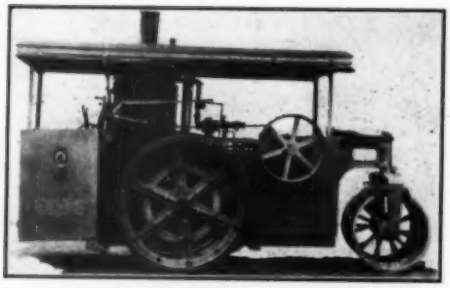
TANDEM rollers, equipped with vertical boilers, which are said to have fewer working parts than any other tandem roller, are made by the Iroquois Works of the Barber Asphalt Company, Land Title Building, Philadelphia, Pa. These rollers have double cylinders and reversible slide-valve engines which rest on a frame made of heavy section steel channels. The engine has slow speed and high power, eliminating the need of a governor. Reverse may be secured by a lever within easy reach of the operator, and is instantaneous in action, which is of particular value when engaged in such operations as rolling or cross-rolling sheet asphalt pavements.



AN IROQUOIS TANDEM ROLLER

The tandem roller is bevel-gear driven, which is said to give less vibration than spur gears. The steering quadrant-saddle, king-post, water-tank and other parts are made of selected and inspected materials. Hand steering wheels within easy reach of the operator are one of the features of Iroquois tandem rollers. A power steering device which allows the steering roll to be turned in either direction with the roller operating forward or backward, is standard equipment on all rollers weighing 5 tons and over. These rollers are furnished in 2½-ton, 5-ton and 8-ton sizes.

A noteworthy change in macadem roller design is the 12-ton vertical boiler Iroquois macadam roller made by the Barber Asphalt Company. This powerful roller is built in separate units, each



A 12-TON MACADAM ROLLER

supporting no weight but its own, which eliminates the rack and strain of the boiler. Repairs or replacements of any parts can be made without tearing down the entire roller. An improved scarifier, located under the operating platform at the rear, is operated by two steam cylinders, and is so constructed that it will scarify under all conditions. The scarifier will penetrate from 4 to 7 inches over the entire width of the roller. When not in use the scarifier is lifted automatically to a position under the platform where it is out of the way. The spikes are easily removed from the rear wheels and the roller can be used for asphaltic and bituminous concrete pavement work when desired.

The vertical boiler of the macadam roller provides increased heating surface and greater steam pressure, which with larger engine cylinders is said to give the Iroquois roller 50 per cent more starting torque than any other 12-ton roller.

Beaver Manufacturing Company Expands

THE Beaver Manufacturing Company, Milwaukee, Wis., has announced that it recently acquired and is now occupying approximately 20,000 additional feet of floor space to provide better facilities for the assembly and test departments. This step was taken because the business of this company has increased approximately 69 per cent over last year's showing.

Pneumatic Hoists Replace Windlasses

By James W. O'Brien

THE Henry L. Doherty Company of New York, C. F. Boldman, superintendent in charge of construction, is building a $1,250,000 addition to the Virginia Power Company's plant at Cabin Creek Junction, West Virginia, in the heart of the Kanawha coal field. In setting piers for the foundation of the power-house, it was necessary to sink 28 caissons to bed-rock along the river bank. These caissons were 6 feet in diameter, and ranged in depth from 20 to 45 feet. The sinking of the caissons was started by using a bucket, handled by a hand-crab or windlass. Two men, using a gallows derrick having a swivel foot which permitted the cross-arm of the derrick with the bucket to be swung to one side so that the bucket could be emptied into a skip, hoisted the material to cars on the bank.

Hoisting by hand, it was possible to handle the buckets at the rate of 25 to 30 feet per minute. Mr. Boldman conceived the idea of using portable compressed-air hoists for the job and has employed six Turbinair hoists weighing 285 pounds each. The hoists were mounted on the derrick upright, as shown in the illustration. Their speed in hoisting the buckets and in lowering them was such as to cut the cost of hoisting two-thirds, and assured a rate of sinking caissons of one foot every two hours.

After the foundation work was completed, the hoists were employed to handle a large part of the 400 tons of structural steel required in the power-house. The first part of the erection was done by means of gin-poles on the ground, and later the hoists were set on the I-beams and the steel lifted directly. Other hoists of this type were employed for odd jobs, such as setting the boiler tubes in place and hoisting bricks, and for repair work around the pump in the river. Several of them will be retained after the construction work is completed, for miscellaneous duties in and about the plant.

TURBINAIR HOIST, GALLOWS FRAME DERRICK AND CAISSON

These small hoists, weighing under 300 pounds each, are rated at 6½ h.p. with compressed air at

75 pounds pressure. They have a lifting capacity on a single line of 2,000 pounds hoisted vertically, or will haul a 100,000-pound load on level track. The motor is almost impossible to stall, owing to the very high torque, secured by the design. All operating parts are tightly enclosed inside of the drum of the hoist itself. A ¾-inch pipe is large enough to supply air for operating these hoists properly.

Turbinair hoists are made by the Sullivan Machinery Company, 125 South Michigan Avenue, Chicago, Ill.

A New Light-Weight Industrial Crane

Machine with Interchangeable Attachments Furnishes 6 in 1 Outfit

A NEW model light-weight industrial crane with interchangeable attachments so that it is equally effective as a crane, as a ditcher, as a shovel, etc., has been recently developed by The Byers Machine Company, Ravenna, Ohio. This model, the "Bear Cat," is virtually six machines in one, built to give speed and economy in all-around work. It is particularly speedy in handling a half-yard clam-shell bucket. A good operator, it is claimed, can easily make three round trips per minute with the bucket on ordinary loose material such as sand or gravel. The ditcher attachment has shown itself to be especially popular, a large number having gone into sewer and trench work last summer. The ditcher scoop is furnished in two sizes, 25-inch and 31-inch, and cuts to a depth of 17 feet behind the machine or 9 feet beside the machine. It will dump at an elevation of 8 feet into trucks, and the power applied at the dipper teeth is 9,500 pounds. The machine can be satisfactorily operated on a grade of 20 degrees.

Equipped with skimmer attachment, the "Bear Cat" is said to be a very efficient road grader. It has a 12-foot cutting stroke and a two-part digging line, giving it a very great digging power for a machine of its size. The ½-yard bucket is of the bottom-dump type, no ground man being necessary. In fact, with all attachments, the Byers "Bear Cat" is a one-man-operated machine. Other attachments provided are a shovel for regular excavating, a back-filler, a dragline and a magnet.

The "Bear Cat" is mounted on full crawlers,

EQUIPPED WITH SKIMMER

WITH DITCHER EQUIPMENT

spaced unusually far apart, giving it traction and stability on all kinds of ground. It is equipped with a 35-horse-power gasoline engine, and is of exceptionally sturdy construction throughout. It can mount a trailer on its own power for quick hauling by motor truck. Electric power can be furnished instead of gas where desired.

THE NEW BYERS "BEAR-CAT" WITH CRAWLER TRACTOR

Trailer-mounted Mixer Saves Money

Time Saved in Pouring Lamp-Post Bases by Unique Mounting

IN concreting lamp-post bases there is often a lot of time lost in moving the mixer from one set-up to the next and in getting ready to pour, but the Electric Contracting Company, of Chicago, has cut this lost time down to a small item. The accompanying illustrations show the outfit they are using, a 14-S Marsh-Capron mixer with a drop-down power loader mounted on a trailer.

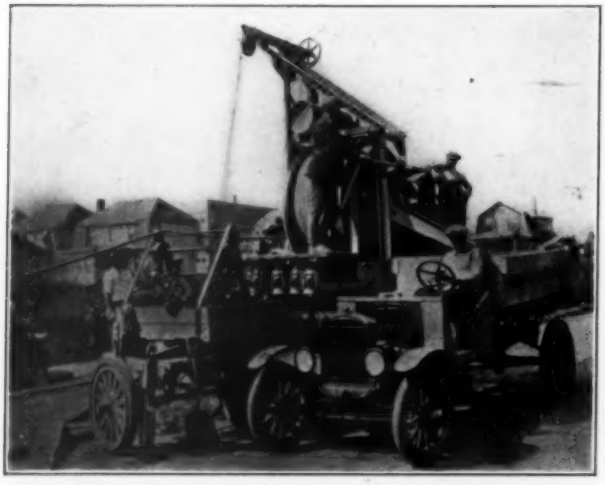
The mixer is ready for action as soon as the trailer stops, and is ready to move on at once as soon as the pour is complete. It travels at motor-truck speed to any part of the city, and the mixer, either a 21-S or a 14-S, gives a big output and cleans up the work quickly. In order to be able to discharge concrete right out of the mixer into dump bodies mounted on Ford trucks, the mixer was blocked up on the trailer, but, as the illustrations show, the drop-down power loader is filled directly from the wheelbarrows on the ground.

The discharge angle of the power loader skip when in raised position insures quick discharge. As is usual with power loader operation, one complete batch is assembled in the power loader while the batch ahead is mixing. The mixing buckets in the drum handle the concrete rapidly, and the discharge chute with its steep angle makes it possible to discharge the entire batch under perfect control in 12 seconds without slopping.

Except for the special mounting and drop-down power loader, the mixer is a standard Marsh-Capron machine with rail tracks for the main drum bearing, turning on mine-car-wheel rollers. The rail tracks take all of the wear of the rollers, so that there is no wear whatever on the outside of the drum shell. Following the suggestion made by the Associated General Contractors of America, every 14-S and 21-S Marsh-Capron mixer carries definite guarantees covering trade-in value and rebuilding cost up to ten years.

It is reported that the trailer-mounted mixer saves $25 a day as compared with results previously obtained with other equipment.

LOADING-SKIP DISCHARGING INTO MIXER
Note track which permits skip to drop to the ground from elevated mixer on drop-frame trailer



DISCHARGE SIDE OF TRAILER-MOUNTED CONCRETE MIXER

Fellowship in Highway Work

THE United Fuel & Supply Company, Detroit, Mich., has recently established a Fellowship in Highway Engineering to be devoted to investigations under the direction of the Division of Highway Engineering and Highway Transport of the University of Michigan, covering advisable methods of sampling and testing sand and gravel to be used in connection with highway improvement. The United Fuel & Supply Company Fellowship will make an extensive investigation of plant production of sand and gravel prior to determining efficient methods of sampling.

When there's something better you want it

Full Force Feed Oiling System

In "Caterpillar" motors full force feed lubricating system is used. Oil is delivered under pressure to the main bearings, thence through drilled passages in the crankshaft to the connecting rod bearings. The grooves in the connecting rod bearings are tapped by a tube running up to the piston pin bearing, thus delivering oil under pressure to all working parts.

The "Caterpillar" can run continuously in extreme position, forward, backward or sideways with lubrication absolutely dependable at all times.

When you buy a tractor, what you get in power, dependability, economy and long service, is much more important than what you pay. It's performance that counts.

The "Caterpillar" is the result of years of research, and the study of your power needs. It is built of the finest materials available, by experts who know how. It has real quality—it is built to last a long time.

The "Caterpillar" will do your most difficult tasks, better, quicker and cheaper than any other type of tractive power. Its simplicity and sturdiness of construction mean ease and economy of operation and maintenance. Its low center of gravity and flexible track construction insure maximum pulling power under all conditions. And Holt-service-to-owners in unequalled. The 2-ton is ideal for all lighter hauling. The 5-ton is an acknowledged leader for all medium power. The 10-ton is supreme for heavy duty.

Find out about the "Caterpillar." We'll be glad to furnish you with convincing facts and figures on "Caterpillar" performance in all parts of the world; on all kinds of work; winter and summer.

The Nation's Road Maker

There is but one "Caterpillar"—Holt builds it.

THE HOLT MANUFACTURING COMPANY, INC.
PEORIA, ILLINOIS **STOCKTON, CALIF.**

Export Division: **200 W. 54th Street, N. Y.**

CATERPILLAR
Reg.U.S. Pat.Off.

A Machine for Drilling Post Holes

Labor-Saving Equipment Digs in Earth, Clay, Shale and Hard-Pan

THE Buda-Hubron earth drill, a labor-saving machine which digs holes from 1½ to 20 inches in diameter in earth, clay, shale and hard-pan, thus cutting labor costs, has been developed by The Buda Company, Harvey, Ill. This machine is particularly useful to contractors in saving labor on such jobs as setting fence posts, digging blast holes in soft material, and for foundation work.

The drill proper, held in a specially designed chuck mounted on the drill spindle, is lowered or fed by hand and raised by power. The large-sized drills, furnished up to 20 inches in diameter, are formed of a single cast steel helix, polished on the top and provided with a special check valve. They are furnished with removable manganese and carbon steel cutters, which can be easily renewed when worn and which are bolted to the helix. When the drill is lowered, the earth, as it is dug up by the cutters, is forced up through the check valve and slips on the polished top of the helix so that it does not turn in the hole with the drill. This feature permits a great saving of power and increases the digging ability of the machine.

When about 2 feet of earth has collected on the top of the drill, the driver clutch is disengaged and the drill raised to the surface by engaging the lifting clutch. The drive clutch is then engaged and the whirling drill throws the dirt around the outside of the hole. The check valve in the drill prevents the return of any earth already dug.

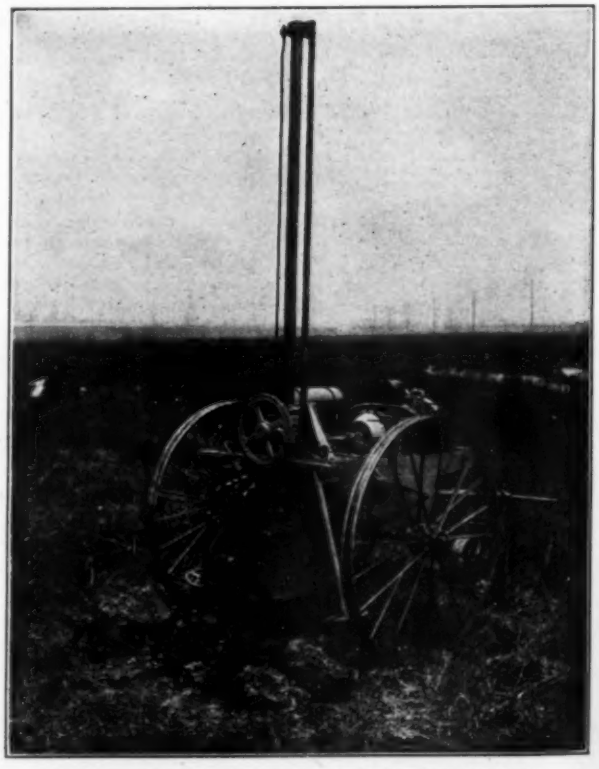
The large drills will dig in earth, clay, hard-pan and shale, and handle without difficulty the small stones ordinarily encountered in drilling. For blast-hole work a special chuck and spindle are furnished and twisted steel drills are used, giving a hole approximately 1½ inches in diameter to a depth of 15 feet. The speed of drilling depends upon the character of the ground, but in ordinary soil an 18-inch hole will be sunk 6 feet in about 5 minutes. On state highway work, in digging 14-inch holes 4 feet deep for guard-rail posts, the machine has averaged from 50 to 60 holes a day. On blast-hole work, in solid shale, it averages from 140 to 180 feet a day.

The machine, mounted on springs, moves upward when the drill strikes an obstruction and comes back into place when the obstruction has been dislodged. The cone friction clutch, connecting the engine to the main drive-shaft, is so designed that it will slip when the drill strikes too large a boulder to be handled, thus relieving any undue strains on the machine. The engine is a standard Buda 2-cylinder, horizontal 4-cycle air-cooled engine, having a 4-inch bore and a 4-inch stroke.

This earth drill weighs about 1,400 pounds and is fitted with two steel wheels 4 feet in diameter which have wide tires and roller bearings; thus it can be easily moved from one location to another by being run up on a motor truck or on a railroad motor car trailer or towed behind an automobile, as it is mounted on springs. The machine can be used on rough or uneven ground, as it may be adjusted to drill at any reasonable angle by changing the position of the tongue post.

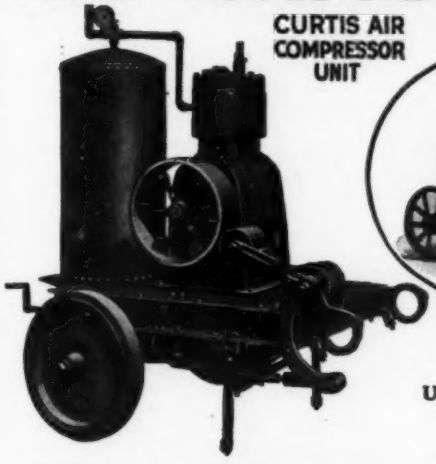
New Los Angeles Office and Warehouse

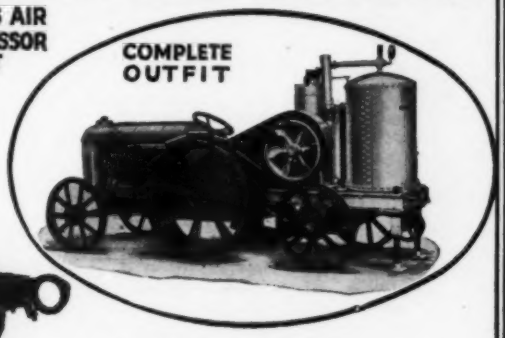
THE Sullivan Machinery Company, 122 South Michigan Avenue, Chicago, Ill., has announced the establishment of a branch office and warehouse at 412 East Third Street, Los Angeles, Calif., with Benjamin P. Lane as local manager. A complete stock of Sullivan pneumatic equipment and supplies will be carried.



A MACHINE THAT QUICKLY BORES OUT POST HOLES

CURTIS-FORDSON AIR COMPRESSOR OUTFIT





Sold as Complete Outfit or Unit Can be Bought Separately

Fills A Much Needed Want

Here is just the thing contractors are waiting for—a portable air compressor unit that operates with any Fordson Tractor, making a complete self-contained outfit. Can be used on a hundred different kinds of jobs where a supply of compressed air is temporarily needed. An outfit that can be moved from job to job quickly by its own automotive power—no extra truck for pulling necessary.

50% More Service

The average contractor can easily get 50% more service out of the Curtis Fordson Compressor Outfit than from the ordinary portable compressor outfit, which is heavy, cumbersome, expensive and serves only a single purpose. It must be remembered that the Curtis Fordson has every quality of the ordinary portable compressor outfit plus the advantages of detaching the Fordson Tractor and using it for all tractor purposes.

Wide Range of Uses

The flexibility of the Curtis Fordson Air Compressor Outfit is remarkable—ideal for the road contractor, structural steel field jobs, oil field work, telephone construction, well drilling, etc. Just the thing to supply air for jack hammer drills, paving breakers, riveting hammers, rammers and tampers, compressed air hoists, sand blasts, stone cutting tools, quarry tools, rivet forgers, clay and coal mining diggers, for pumping water, for washing autos and trucks, unloading tank cars, paint spraying, caulking pipe lines, etc. For city streets can be equipped with rubber tires.

Tractor Used Independently

When the Curtis Fordson is not being used as a compressed air outfit, the Fordson Tractor can be detached and used independently for hauling, loading, moving or power-driving purposes. The coupling is simple—nothing to get out of order or misfit. The whole arrangement is sturdy and practical—the Air Compressor Unit can be attached or detached by anyone in a few moments.

If You Now Have a Fordson

The Curtis Air Compressor Unit can be purchased separately. Used in connection with a Fordson, it opens new fields of work for the tractor and an additional source of revenue for you. You know the reliability of the Fordson—and you know the reputation and dependability of Curtis Air Compressors. The Curtis Unit is backed by 70 years' manufacturing experience, 27 of which have been devoted to the manufacture of pneumatic machinery, and our $1,500,000.00 institution. So you take no chances whatever.

Reasonable in Cost

The Curtis Fordson Air Compressor Outfit can be purchased complete, tractor and all, from us, or the Curtis Compressor Unit can be had separately. Mail coupon for full particulars and prices.

Curtis Pneumatic Machinery Co.
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Gentlemen: Please send me full information, your proposition and prices on:
☐ Curtis Fordson Air Compressor Outfit Complete
☐ Curtis Air Compressor Unit Only
I am an authorized Ford dealer, I sell . . . . . cars
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Survey of Building Costs in Winter

"The Ebb and Flow in the Demand for Construction, Seasonally and Between Different Years, to a Large Degree Affect Our Economic Stability."—Herbert Hoover

IN the report on seasonal operation in the construction industries, it is stated: "Bad weather is not the principal cause of seasonal idleness. Customs which became fixed when builders had not yet learned how to cope with adverse weather conditions have not been changed to meet improvements in building materials, the development of new equipment and innovations in management methods. For most types of construction it now is possible to build the year round in all parts of the United States."

Data assembled by the United States Gypsum Company, 205 West Monroe Street, Chicago, Ill., which is undertaking to do its share in the movement to educate potential builders to the fact that they can advantageously build in cold weather and how they can do so, show that building costs in winter are materially less than those in summer. Completion is quicker, materials are cheaper during the off season, labor is more efficient, easier to find and less exacting as to wages, and contractors who employ men the year round are not confronted with demands for bonuses and extra wages such as are demanded during peak seasons when the industry is working on a basis of eight months out of twelve. Modern equipment makes it possible to maintain the proper temperatures in buildings under construction at lower cost than previously was necessary.

In the survey conducted by the U. S. Gypsum Company, reports were obtained on one building costing $750,000 on which a saving of $87,710 was made by winter construction. The total cost of protecting it from the weather was $3,863, made up of temporary protection for labor and materials, $871; tarpaulins, $667, with a salvage of $442; temporary heat, $668; salamanders, $302; coke, $304; boiler attendants, $1,036; coal for boiler heating, $150; temporary lighting, labor and service, $196, and snow clearing, $111.

Bricklayers, who during the previous summer were paid $14, $16 and even $20 a day, worked on this job at $10, and their efficiency was found to be 18 per cent greater than in hot weather. The brick work cost a total of $28,150. Had it been done during the peak period of the preceding summer, it would have cost $5,630 more. Savings on other labor amounted to $25,680, and $16,030 was saved on materials as compared with what they would have cost in the summer.

Another contractor estimates that protection of concrete in winter cost him 5 per cent of the contract, but that this was more than offset by economies in labor costs.

Similar economies are possible through the use of gypsum building materials. Many of them are factory-cast and consequently are unaffected by temperature, and those that are not cast, set into their initial hardness more quickly than other materials. Sheetrock wallboard is one of the cast materials and it makes winter construction of small dwellings possible. For this reason it has been used in many housing projects which had to be completed in winter. Besides being unaffected by cold, this material has the advantage of coming in large units, which speeds up installation and effects economy in labor costs. In analyzing conditions affecting plastering, the United States Gypsum Company has recognized that one of the principal dangers is that the keys which form the mechanical bond between the plaster and the wood lath are likely to freeze before they set and so fail to function as a clinch. Even where steam coils and salamanders are installed, there is a danger that while the plaster on the inside may set, the keys will freeze. For this reason the company has perfected Gyplath, a fire-proof substitute for wood lath, which entirely eliminates the keys and makes it possible for the plasterer to work on a solid background of insulating material which keeps the cold out until the plaster on the walls and ceiling has entirely set. This has caused many contractors to specify this type of plaster board for winter work.

The advantage of using gypsum plaster is that it sets in a few minutes and attains virtually its full strength within 24 hours, so that it is not necessary to maintain heat in a gypsum-plastered room more than one day.

An Opportunity for Road Contractors to Study

THE Department of Civil Engineering, University of Michigan, Ann Arbor, Mich., has announced a series of professional short-period courses in highway engineering and highway transport, designed primarily for mature men in practice. These courses will be given at the University of Michigan during two-week periods from December 8, 1924, to March 20, 1925.

The courses will cover, Dec. 8-19, highway engineering financing, management and organization, American and English highway transport methods; Dec. 22-Jan. 2, highway transport economics and surveys, gravel and quarry plants, and gravel and broken stone roads; Jan. 5-16, brick, cement concrete, stone block and wood block pavements, highway engineering theory and design, interrelationship of highway, railway and waterway transport; Jan. 19-30, bituminous surface treatments, bituminous macadam, bituminous concrete and sheet asphalt pavements, highway transport management; Feb. 2-13, highway laboratory research, highway structures, mechanism, operation and maintenance of motor trucks, tractors and trailers; Feb. 22-Mar. 6, highway specifications, contracts and jurisprudence, highway transport costs and record systems; Mar. 9-20, highway engineering theory and design, grading machinery and operation, drainage systems, earth and sand-clay roads, highway transport legislation, traffic engineering and its application to street design and city planning. Further data may be secured from Ann Arbor, Mich.

CHARACTER

Years ago every barrel of flour which bore the brand, "George Washington, Mount Vernon," was exempted from the otherwise uniform inspection, not only in our colonies but in the West Indies. Washington's name was ample guarantee of the quantity and quality of any article to which it was affixed.

In the days of "wild cat" money in the West, **Ames Shovels** were used as currency. There was a time when the price did not vary one cent in twenty years. They were as stable as gold coin simply because character was worked into each shovel. The name of **Ames** was a synonym for honesty and it passed current all over the world. The brand of "O. Ames" was as good at the Cape of Good Hope or in the far off isles of the sea as in Massachusetts where the shovels were made.

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you can get it in shovels by simply specifying

"O. AMES" BRAND

The Standard for 150 Years

Distributed throughout the United States by the foremost dealers only

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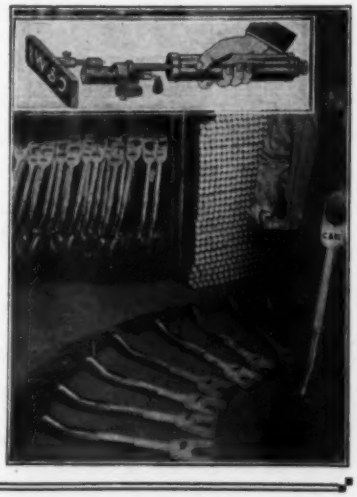
Branded Tools *"Wear Out"*
Unbranded Tools *"Disappear"*

YOU lose tools and equipment on nearly every job due to intentional theft or unintentional appropriation. Your tools get mixed up with others and the contractor with the easiest conscience comes out ahead.

Therefore

You have long felt the need of an inexpensive branding iron like the Everhot for quickly branding tools, sheeting, wheelbarrows and other equipment.

The torch of the Everhot branding tool keeps heating the brand all the time you use it, so it stays hot and brands continuously. It was designed especially for contractors' use in protecting their equipment.



Everhot equipments are priced as low as $14.00.

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FOR ALL MAKES OF ROAD GRADERS AND DRAGS

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WE CARRY 5,000 FINISHED BLADES IN STOCK AND CAN MAKE PROMPT SHIPMENT

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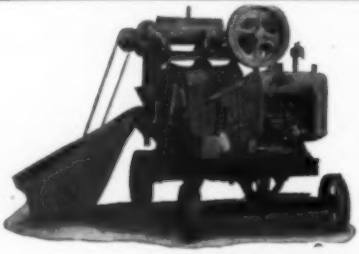

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We build 3½ ft., ½ bag, 1 bag and 2 bag Mixers.

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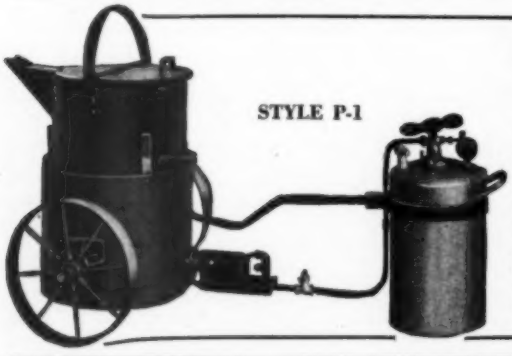

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10 to 1000 Gallons Capacity Carried in Stock.

Style P-1 Oil Burning Patrol Patching Heater is used for heating small quantities of tar, pitch, asphalt or bituminous filler as used in connection with asphalt brick and granite stone or wood-block paving. This outfit heats twice as fast as one with a wood fire, and is particularly useful in city streets as it burns without smoke and leaves no hot ashes on the pavement.

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Would You Give Your Wife A Warford?

YOU'D never think of giving your wife a Warford Auxiliary Transmission for a Christmas present. There are a thousand and one other things that might please her more—things you may or may not be able to give.

Nevertheless, Warford is making a merry Christmas merrier for those who have cut their hauling costs in two. For Warford Transmissions are buying thousands of Yuletide gifts for the wives and families of owners of Warford equipped Ford Trucks.

Now, at the end of the year, look up your transportation costs. Figure how much Warford could save you in providing a 2-ton Ford truck that operates at Ford 1-ton cost, that replaces units costing three times as much. Then call up your Ford dealer and buy your wife a Warford—not for this Christmas, but for next.

If the Ford dealer hasn't Warford, write to the nearest distributor.

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Dealers' Warford Co. - Memphis, Tenn.
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Dyke Motor Supply Co. Pittsburgh, Pa.
Foster-Warford Co. - Auburn, N. Y.
Hall-Warford Co. - Charlotte, N. C.
Hammel-Gerke Co. - Los Angeles, Cal.
Houdaille-Polk Co. - Dallas, Texas
E. W. Jay - - - Vancouver, B. C.
Kenney Equipment Co., Indianapolis, Ind.
H. N. Knight Supply Co. Oklahoma City, Okla.
McGee-White Corporation Minneapolis, Minn.
Massachusetts Warford Co. Haverhill, Mass.
Motive Parts Corporation, New York City
Motor Specialties Co. - Denver, Colo.
Price Auto Service Co. - Wichita, Kan.
Sieg Company - - Davenport, Iowa
Sieg-Warford Co. - Chicago, Ill.
Transmission Sales Co., Stockbridge, Mich.
Wade and Dunton Motors Inc. Lewiston, Me.
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The Warford Corporation, 44 Whitehall Street, New York City

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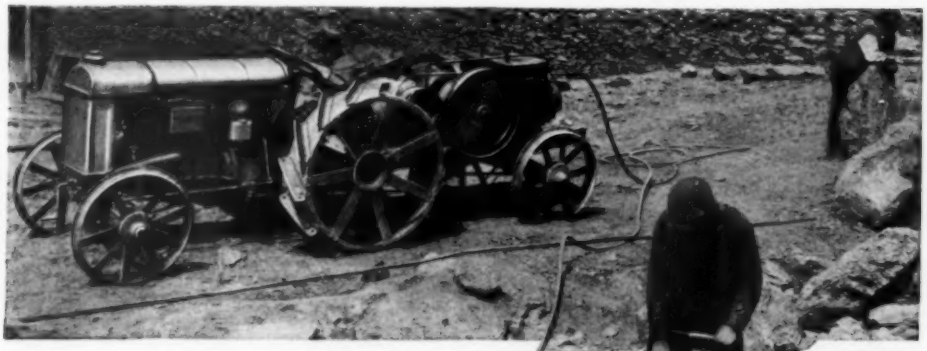

Reduce Power and Haulage Costs With the Fordson

One power plant now serves the needs of contractors, builders, engineers, supply dealers and municipalities. It's the Fordson!

For here is a power unit that functions either as a stationary power plant or for motive purposes. It furnishes the power for excavating, rock crushing, pumping, grading, heavy hauling, road building and maintenance, hoisting, transporting tools, supplies and men, etc.

Reports from users show unusual savings. The Imperial Sand & Gravel Screening Co., Columbus, Ohio, saves $16.25 a day by hauling sand to the tipple with a Fordson instead of teams.

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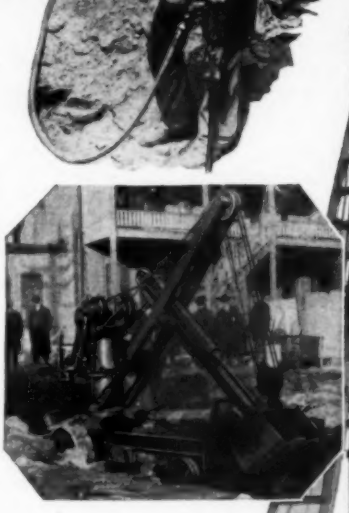
Your nearest Authorized Ford dealer can furnish additional facts and figures on the cost of operating the Fordson in your business. Call for this information and a practical demonstration.



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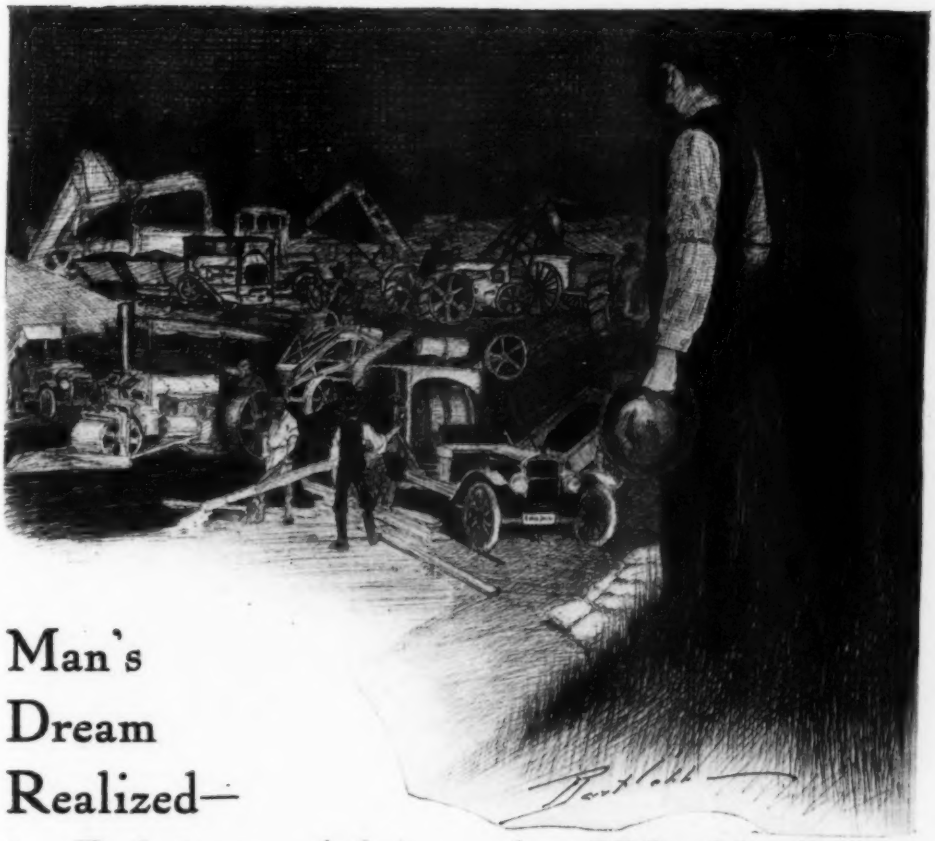

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These men, alive to the ever-growing use of Fordsons, Ford one-ton trucks, and equipment for use with them, appreciate that in the Ford Power Equipment Exposition they have a clearing house for all Ford power equipment information.

The service that the Exposition renders, rightfully considered so important and valuable, is available without charge to every Engineer, Contractor, Builder and Municipality. Come to the Exposition yourself or write for any information on Hoists—Portable and Stationary, Air Compressors, Agricultural Implements, Saws and Planers, Excavating and Grading Equipment, Material Loaders, Dump Bodies—Hydraulic and Gravity; Electrical and Service Shop Equipment, Trucks, Trailers, Concrete Mixers, Locomotives, Snow Plows, Rollers, Arc Welders, Back Fillers, Scoops, Scrapers, Wheels, Crawlers, Shovels, Saw Mills, and Special Auxiliary Equipment of Springs, Governors, Seats, Cabs, Pulleys, Hitches.

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Rates: $11 to $25 per week
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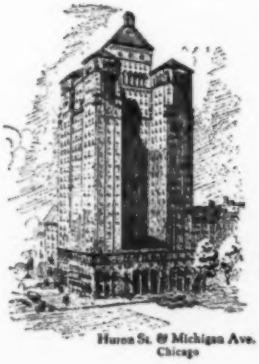

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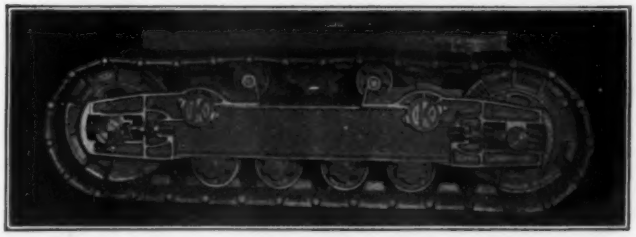

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Dragline Capacities

No. 1—¾ cubic yard dragline bucket on 35' boom or ½ cubic yard dragline bucket on 40' boom. Four cylinder 5" x 6" gasoline engine. 1000 R. P. M.

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LOOK at the smooth top side of the planes—at the construction of the tumblers—all perfectly self-cleaning—and no pockets for stones, gravel or dirt. Planes and links are cast in one piece, high carbon annealed steel, shod with high carbon steel treads. Links extend across entire width of shoes. Shearing or bending strains on links and pins are distributed over nine points between the shoes, practically doing away with the bending and shearing so common to ordinary construction.

The Koehring multiplane is especially designed for dragline, shovel, and crane service. It is another item of Koehring Heavy Duty construction which means trouble free, long service life.

Designed for Gasoline

The Koehring is not merely powered with a gasoline engine—it is especially designed in every detail for internal combustion power. Likewise the standard gasoline engine is designed with built-in speed-reduction gearing. Both are factors for better service, livelier, more responsive action and control so important to longer service life.

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for profitable Transport service

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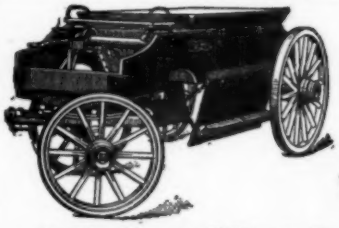

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Turn to Page 3

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Fifteen years of experience has put quality and workmanship in these plows that now makes them popular favorites.

The Baker Snow Plows are made for large and small tractors and trucks. Send for our big snow plow catalog.

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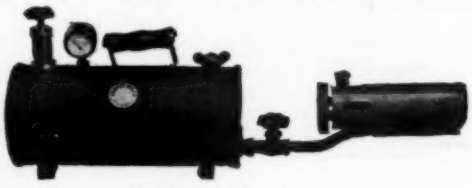

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Atlas Engineering Company

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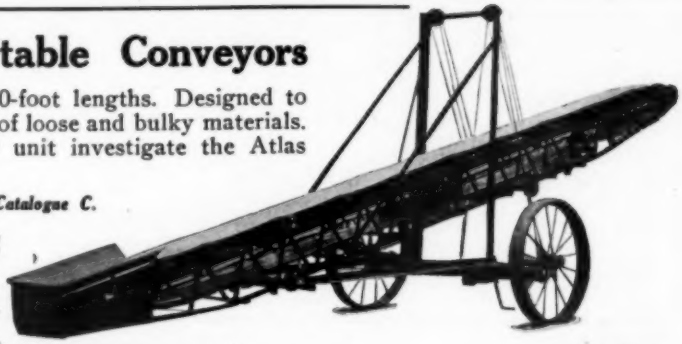

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The Huber Steam Roller has been standard equipment with road builders for many years. Always dependable. The Huber One-Man Road Maintainer is economical and the four cylinders furnish excess power. Has weight enough to hold blade down when making heavy cut and pulls a detached grader when necessary.

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Concrete Busher for bushing concrete surfaces.

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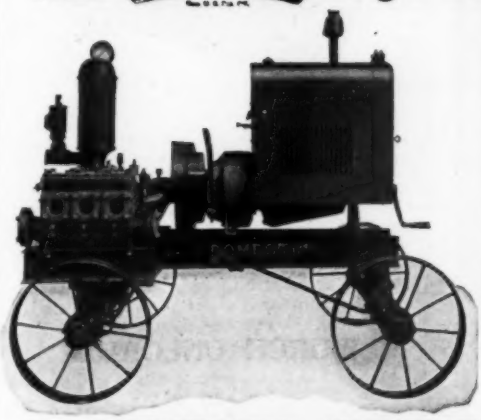
This DOMESTIC High Pressure Triplex Unit



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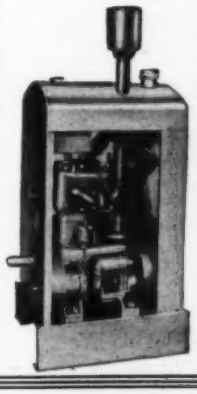

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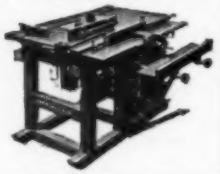

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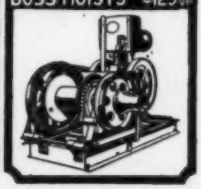

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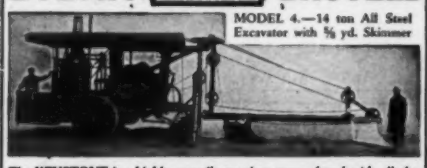

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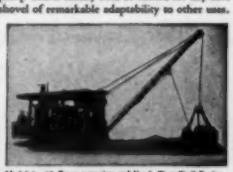

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Dean Brothers Company, Steam pumps.
The Ironton Engine Co., Storage battery locomotives.
Insley Mfg. Company, Concrete handling equipment, steel derricks, industrial cars.
Mead-Morrison Mfg. Co., Hoists and Grab buckets.
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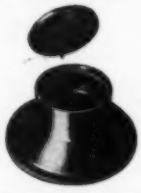
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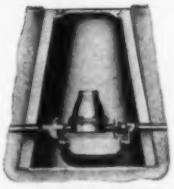
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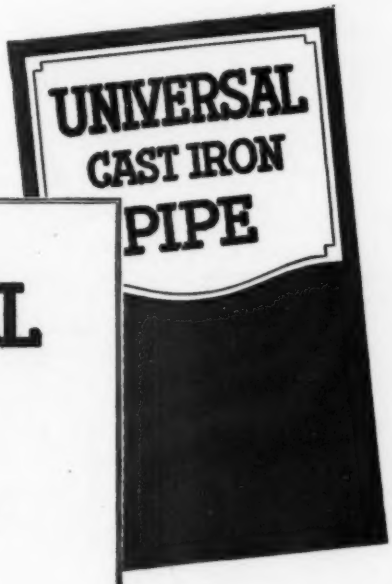

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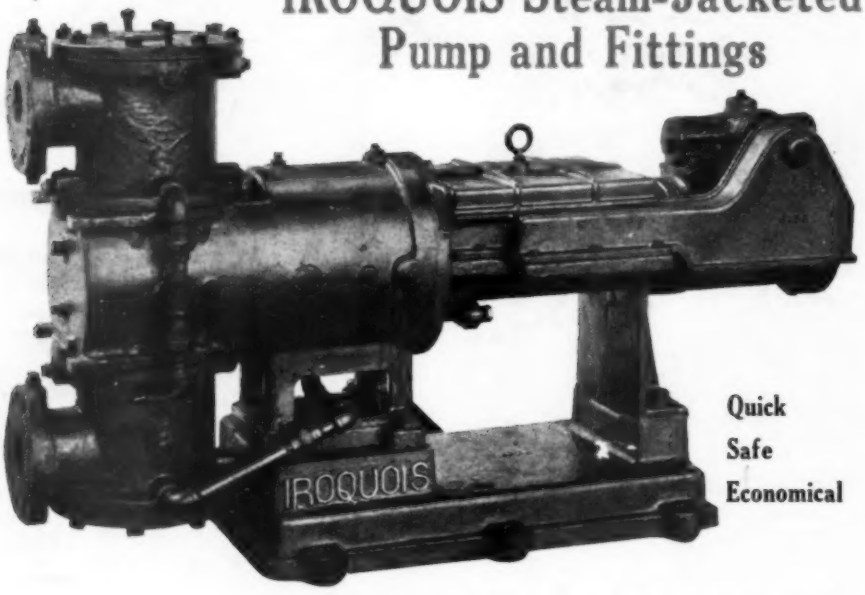

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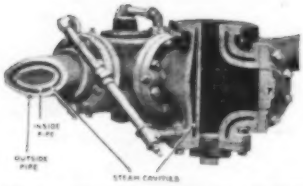

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